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The Chemical Age 1 March 1952

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VOL LXVI 1 MARCH 1952 No 1703

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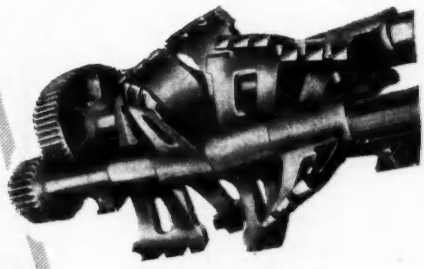

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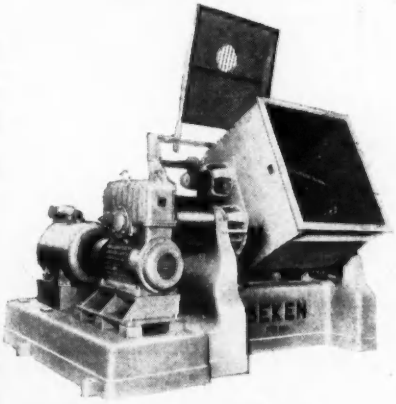

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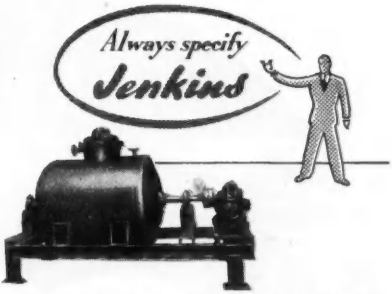

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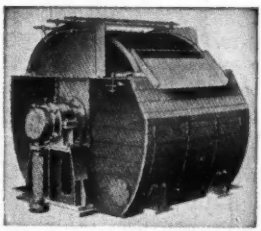

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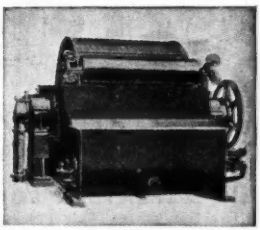

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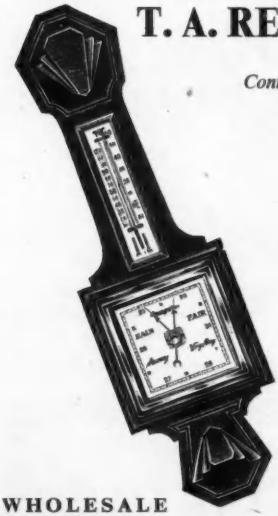

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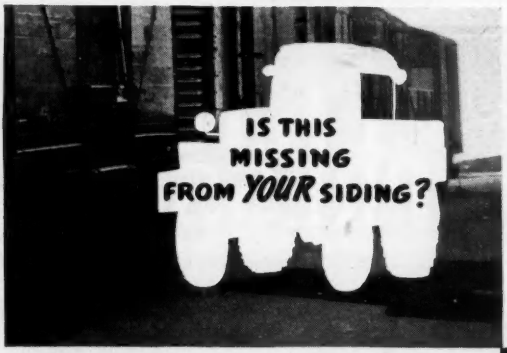

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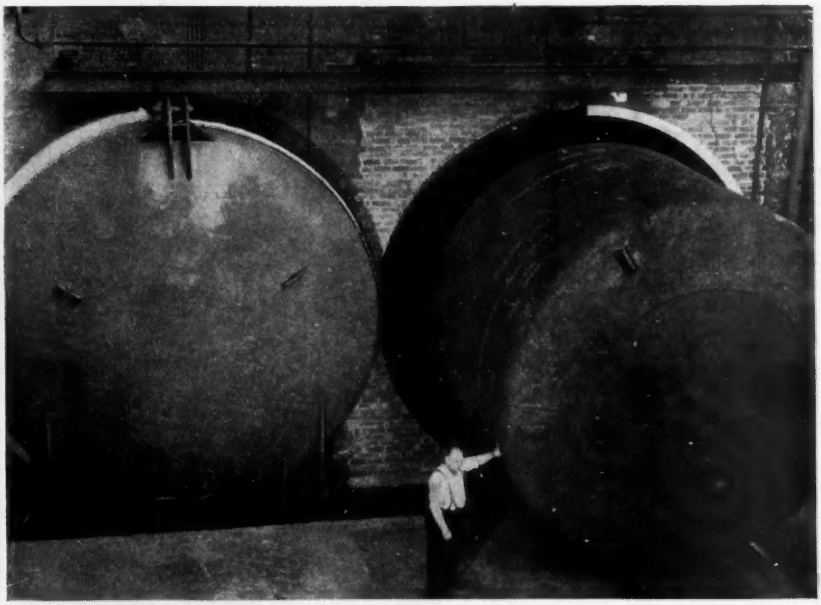

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Volume LXVI 1 March 1952 Number 1703

The American Example

WHY is it that the British chemist appears to take less interest in his profession than his American counterpart? Is this seeming apathy due to his own internal make-up or is it that he has gradually lost interest due to weaknesses in organisation? These questions are vital at the present moment as reports of declining attendance are coming in from all parts of the country and the membership of some professional bodies is not increasing at a satisfactory rate.

This matter was again brought into prominence last week during the discussion which followed the excellent talk on 'The Organisation of the American Industry' given to the Royal Institute of Chemistry by Dr. R. L. Kenyon, London associate editor of the American Chemical Society's publications. Dr. Kenyon explained that the problem in America was not a question of attracting members, but how to cope with the vast numbers which wished to attend not only the national and divisional, but also the local meetings. A member of the RIC, quoting Dr. Kenyon's figures of 67,000 members of the ACS and a peak attendance at the annual meetings of 11,000, pointed out that this was about one sixth of the members. The RIC, he said, had some 12,000 members but an attendance at an annual meeting of 2,000 was absolutely unheard of. The speaker (who did not, however, point out that the attendance at the 1951 annual meeting was only around 70) wondered what was the reason for the apparently greater enthusiasm in the U.S.A. He wondered whether it was partly due to firms granting time off and paying expenses. Another member suggested that there were too many meetings in this country.

Most chemical firms in America pay transportation and living expenses for employees wishing to attend out-of-town meetings and it is usual for them to pay registration fees and even a moderate entertainment allowance. Dr. Kenyon said that this had been found to be good policy, for it was soon realised that senior chemists would not go to any concern when it became known that these facilities were not granted. Conferences were appreciated for the papers read but a great part of their value lay in the acquisition of new knowledge and information on research gained through gossip and the opportunity to meet new people and renew acquaintances. In many trades in the U.K. firms now realise the importance of conferences, symposiums and meetings and encourage key personnel to attend. In the chemical industry, however, there are still firms

which do not fully appreciate the value of encouraging their employees to mix with other members of the profession. Living costs are now extremely high and it seems only reasonable that employers should grant expenses to cover attendances at scientific and technical meetings. On the other hand something could and should be done with regard to reducing expenses. Would it not be better to hold annual meetings in reasonably accessible areas? Is it not preferable to arrange the venue to suit the majority of members rather than to arrange it merely to give each of the local associations a chance as host?

Criticisms of the slow publication of papers in this country were raised at the meeting mentioned and were contrasted with the speed and efficiency of the vast abstracting organisation developed by Dr. Crane in America. While the situation in the U.K. has undoubtedly improved in recent months it is still thought by many to be intolerable and it has been said that interest is dwindling as a result of this. The critics should remember, however, that while Britain's difficulties regarding paper and printing are greater than those in the United States, the time lag there is practically as long. The average paper, we are told, does not appear until six months after it has been submitted to the ACS. It is only fair to point out, however, that summaries are usually published at an early date and papers for which it is unlikely that space can be found in one of its scientific journals are quickly released for publication elsewhere. While it may be that a greater effort could be made to improve conditions, it is even more certain that this difficulty in the matter of getting papers published promptly is a strong argument for better attendance at meetings.

One speaker on Wednesday said that the whole set-up and traditions of Britain and America were so different that it was not necessarily advisable, however efficient an organisation might seem, to try to force the system of one country on another. No one has ever said they should be, but surely we can learn from the success of others. The same speaker said he thought the present system of decentralisation was best suited to this country and there are still many who will agree with him. On the other hand there are now 5,000 members of the RIC who have joint membership subscriptions to the three chartered bodies—The Chemical Society, the Society of Chemical Industry and the Royal Institute of Chemistry. In a compact country such as ours it should be possible to meet a common danger by united action. Is not a merger of the resources of the various chemical organisations a possible solution? Already a large number of joint meetings are being held, and this tendency could be carried much further.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Out of Step

NORMALLY we journalists pride ourselves on our tolerance and we do not believe that we are prone to acts of extreme emotion. Last week, however, we were on the verge of doing something violent. The cause of our irritation was a leader entitled 'This Crisis' appearing in the February issue of *The Chemical Worker*, the official organ of the Chemical Workers' Union. In this editorial the editor endeavoured to blame Britain's present economic condition on the capitalist system and stated that the only way it could be solved was by abolishing it and introducing common ownership. According to him most of the evils of society—such as perpetual wars, unemployment and high taxation—lie at the door of capitalism. With responsible trade union leaders, industrialists, politicians, economists and others all trying to awaken people to the danger, Mr. Beech has the following to say:

> 'Industry, and in particular the chemical industry, can easily stand a considerably increased wages bill and still make a comfortable profit. Therefore, we suggest in all seriousness, the demand for a substantial wage increase should be met without further delay.
>
> 'The old, old story, that the nation is passing through a crisis is wearing a trifle thin. We have been hearing all this since the war, during the war, before the war, all through the years of depression and the first world war. In fact, as long as the older generation can remember there has always been a crisis and the workers have always been called upon to pay.
>
> 'This crisis that "tops the bill" is in fact only a crisis within the capitalist system. . . . Therefore, why should the masses of people be concerned about solving the crisis within the capitalists' system.'

Is it not time that those who belong to the C.W.U. took steps to inform their officials that they are no longer going to permit themselves to be used as tools in any intrigue—be it domestic or international? We cannot believe that the rank and file members—few as they are compared with chemical workers in other unions—have the same political views as their leaders.

Dearer Steel

STEEL is used in a manifold number of manufactures and any rise in its cost is bound to have widespread repercussions. The chemical industry with its plant, apparatus and constructional work, must rank high among the users of steel, and is therefore bound to be affected by any variations in its price. It has been apparent for some time now that the increasing expense of coal, coke, foreign ore, refractories, transport and wages must affect the cost of steel production, while it is also reasonable to expect that, with the present extreme scarcity of the metal, more should be paid for it. Mr. S. J. L. Hardie, who resigned this week as chairman of the Iron and Steel Corporation, was not supported by the majority of the members of the corporation, and his suggestion that imported steel should be subsidised, would only have created an artificial price and helped to increase the inflationary gap. The rise of £4 a ton announced by the Minister of Supply on 26 February actually passes on only about three-quarters of the increased costs, while even at the new price, U.K. steel will be cheaper—in some cases considerably so—than other European countries and the U.S.A., with the exception of Germany and Belgium, which it will approximately equal.

Britain and America

DESPITE a friendly rivalry and healthy competition which must exist between two nations competing in world markets, the American chemical industry has always shown a keen appreciation of its virile British counterpart and the problems with which it has to contend. This spirit of goodwill has again been manifested recently by an editorial which appeared

in two American chemical magazines published by McGraw-Hill. Headed 'A Message to American Industry,' and entitled 'How to Help Britain . . . and Ourselves,' the purpose is stated to be how to assist Winston Churchill to obtain the aid Britain needs to weather her present financial crisis, and if possible to prevent its recurrence. This, it is emphasised, is not a philanthropic purpose. Britain is the staunchest ally of the U.S.A. in the free world's continuing fight for survival, and to fulfil this rôle she must be financially sound. Emphasis is laid on the need for greater production. It is suggested that a wider use of better industrial methods and modern tools and an infusion of the competitive incentive into British industry—to replace the cartel and other restrictive practices—would go a long way towards narrowing the gap between British and American worker productivity. Such a clear-sighted appreciation of Britain's problems, supported by the good wishes for her success, expressed in journals widely circulated in the U.S.A. cannot fail to leave its impression on American industry. It is up to Britain to see that this confidence is not misplaced.

IN THE EDITOR'S POST

Fluid Hydroforming

Sir: It has been brought to our attention that the article by P. Sherwood on Fluid Hydroforming in your 15 December 1951 issue contains the following inaccuracies: The first paragraph of the article refers to the Fluid Hydroforming process as having been developed jointly by Standard Oil Development Company, M. W. Kellogg Company and Standard Oil Company (Indiana). Actually the development work on this process was conducted by these three companies independently, although more or less concurrently, and the agreements providing for an exchange of information were entered into subsequent to the development period.

The third paragraph of this article states that chromia-alumina catalyst is used in the process. This is incorrect in that the chromia-alumina catalyst was abandoned early in the development work on the fixed bed hydroforming process in favour of a molybdena-alumina catalyst, and use of the latter is being continued in the fluid hydroforming process. Very truly yours,

W. H. GUERNSEY.

The M. W. Kellogg Co., Jersey City.

Rodent Control

Sir: In view of the article in your issue of 16 February on Rodent Control by Warfarin, we think we should draw your attention to the fact that this Company originated the idea of the use of anti-coagulants as rat poisons, using Dicoumarin. Subsequently Warfarin was developed as a result of work following this Company's discovery, and it has been manufactured in this country by us for approximately two years.

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N. G. BLENKINSOP.

Ward, Blenkinsop and Co., Ltd.,
London.

Conservation of Sulphur

Sir: You will probably be aware of the recent issue by the Ministry of Materials of a notice in which information was given about the allocation of sulphur for the first half of this year. You will have noted that this allocation is less than that for the second half of 1951.

The Ministry and the industry are concerned that the greatest possible economy be realised in the use of sulphur and sulphuric acid, since both these materials are vital not only to the chemical industry but to industry generally. It is, therefore, in the interests of everyone that both materials should be used as economically and as efficiently as possible, and I write to ask you to be good enough to give prominence to this matter in an early issue.

In addition we feel it would be helpful if you also drew the attention of your readers to the guidance which can be given by the bodies listed in the Ministry of Materials Note MM 3/52 of the 24 January.

We very much hope we can count upon you to help in this most important matter. Yours sincerely,

H. W. VALLENDER.

Association of British Chemical Manufacturers, London.

Modern Developments in Soil Science

New Techniques & Applications Reviewed

IMPORTANT trends in the development of soil science, the encouraging progress of the study of this subject and the new knowledge gained, which should materially assist in the problem of increasing much-needed food supplies throughout the world, were outlined by Sir William Ogg, M.A., Ph.D., LL.D., director, Rothamsted experimental Station, when he delivered the Fernhurst Lecture to the Royal Society of Arts, London, on 20 February. The Earl of Radnor, K.C.V.O., was in the chair.

Most things in agriculture could not be hurried, pointed out Sir William at the start of his paper entitled 'Modern Developments in Soil Science'. From its very nature and the complex problems involved, soil science was not a subject in which spectacular and rapid advances could be expected, but a steady progress had been made in most branches.

Mankind had been interested in soils from the beginning of civilisation but its knowledge was purely empirical and the application of science to soil problems began little more than a century ago.

The subject might conveniently be considered in two broad divisions. The first dealt with rock weathering, soil formation, soil classification and mapping, and the term pedology, from Κεδον, ground or earth, was often applied to this type of work, although it was also sometimes applied to soil science in general.

Soil Fertility

The second division was concerned with soil fertility and dealt with drainage, cultivation, manuring and other factors, and processes which have a bearing on the use of soils for agriculture, horticulture and forestry. In recent years attention had also been given to the soil problems of civil engineering in connection with housing, roads and reservoirs, and this aspect was usually referred to as soil mechanics.

Russian scientists were the first to attempt a genetic classification. They recognised the following soil-forming factors: the nature of the parent material, climate, vegetation, topography, living and dead organisms and the length of time the various processes had been at work. The essence of their teaching was that soil was not merely a mass of rock particles mixed with organic matter or humus but a highly organised body that evolved and changed in the course of time and yet retained its individuality.

Perhaps the most important part of the Russian contribution was the discovery of the close association between soil, climate and vegetation and the recognition of soil zones corresponding in a general way to the zones of climate and vegetation.

World Classification System

Although complete agreement about a world system of classification had not yet been reached, soil surveys were now in progress in many parts of the world. At present there were eight surveyors in Scotland and 15 in England and Wales, the work for the whole country being co-ordinated by a Soil Research Board under the Agricultural Research Council.

The inorganic portion of the soil consisted of material ranging in size from stones and gravel down to clay. The clay was the result of intense weathering and it was not only the most chemically reactive fraction of the soil but also conferred on it such properties as plasticity and cohesiveness. Consequently, the study of soil clays was particularly important in relation to soil formation, cultivation and crop nutrition.

Various new techniques had been applied recently to the study of clay minerals and probably X-ray diffraction methods were the most useful, but much assistance could also be obtained from differential thermal analysis, electron microscopy, and electron diffraction.

An outstanding advance was the recognition of the crystalline character of clay minerals and much attention had been given to the study of their structure. The principal minerals recognised are those belonging to the kaolin and montmorillonite groups, illites, vermiculites and chlorites. Clay fractions of soils also contained crystalline and amorphous sesquioxides, silica, various unstable complexes and humus.

Compared with the advances made in the

study of the inorganic portion of the soil, progress in knowledge of the organic matter had been disappointingly slow. This was not due to any lack of interest or effort: the subject had an enormous literature. Rather had it been due to the complexity of the problem and the difficulty of separating the humus from unhumified plant remains.

Difficulty of Separation

Apart from the difficulty of separating the organic from the inorganic material of the soil, research had been hindered by the lack of suitable methods of investigating the high-molecular colloidal complexes that appeared to be characteristic of soil humus. In recent years, however, more refined methods of investigating naturally occurring macromolecules had been introduced and some of these would prove extremely useful in research on soil organic matter. For example, much detailed information regarding the protein and carbohydrate materials in soils had already been obtained by application of modern paper-chromatographic methods of analysis.

Much useful information could be obtained by indirect methods of approach. It was now recognised that excreta and dead bodies of micro-organisms were important secondary sources of humic substances and valuable information was being obtained by studying the chemical composition of fungi and bacteria, and of the products elaborated by these organisms.

There had been some interesting attempts recently to reproduce the effects of organic materials in maintaining soil structure. J. H. Quastel and D. M. Webley, working on a Rothamsted soil, found that the addition of the sodium salt of alginic acid, a long-chain compound, improved aeration, water-holding power and crumb stability.

A firm of chemical manufacturers recently announced that it was producing a synthetic water-soluble polyelectrolyte with somewhat similar properties. The mechanism by which such materials stabilise soil crumbs was still obscure and extensive testing in the field was necessary to establish the conditions under which they might be used. They would require to be very resistant to attack by soil micro-organisms, otherwise their effect would be transient.

Considerable progress had been made recently in chemical methods of controlling another troublesome pest, the wireworm. Certain of the new insecticides had proved effective both as seed dressings and applied to the soil, the latter having the more lasting effect, but in considering the use of insecticides for the control of soil pests, due consideration must be given to their possible effect on the soil micro-organisms and to the risk of tainting the crops grown.

Soil contained a vast population of micro-organisms. These played a leading rôle in the breakdown of soil organic matter and were involved in many of the changes which took place in the mineral constituents of soils. There was, for instance, the building up of organic phosphorus compounds, the action of sulphur bacteria in making phosphate available to plants, and the influence of micro-organisms on the iron and manganese cycles.

Much of the increase in food production in Britain during and since the war had been the result of using more lime and fertilisers, and using them to better purpose. In both Britain and the U.S.A., fertiliser consumption had almost trebled in the last 10 years, but surveys of fertiliser practice, recently carried out in this country, showed that far too many farmers were still using inadequate or unsuitable fertilisers.

The Organic School

Attempts had been made in some quarters to create a controversy over the respective merits of organic manures and fertilisers. It had been claimed by some advocates of organic manures that fertilisers poisoned the soil and were injurious to the health of plants, animals and human beings. There was no evidence to support these views.

An important advance in the study of soil fertility, was the recognition of the part played by what were termed the micro-nutrient or trace elements. It had, of course, long been recognised that for normal healthy growth, plants required other elements in addition to nitrogen, potassium, phosphorus and calcium, but until comparatively recently it was assumed that these four were the only ones it was necessary to add as manures. For most soils that was the case, but it had now been shown that deficiencies in other elements were much more common than was supposed and that they give rise to deficiency diseases not only in plants but in the animals which consumed them.

A Review of Phenol Analysis

Part II—Qualitative : Colorimetric (Inorganic) & Physical

MOST of the earlier colorimetric methods for the detection of phenols were based on reactions with inorganic compounds. Many of the tests were very sensitive and are still of value, but they suffer generally from their lack of selectivity.

Guglialmelli[22] reported that arsenotungstomolybdic acid gave colour reactions with all phenols (mono-, di- and poly-hydric). Acid groups, such as —COOH and —SO_3H, did not inhibit the reaction, but electronegative groups such as halogens caused considerable diminution of the intensity of coloration, while —NO_2 groups entirely inhibited the reaction. The —CHO group impeded the reaction in monophenols only, and hydrocarbon side-chains (such as methyl, ethyl, etc.) had no effect.

In a later paper[23], the same worker used this acid and arsenotungstic acid reagent for the detection of phenols in essential oils. The oil (1-2 ml.) was dissolved in 10 ml. of ethanol, and the test could be completed in less than 10 minutes. In addition to their reactions with phenols, the two reagents also gave a sensitive reaction with phenolic amines in essential oils. The colours produced were such that a colorimetric determination was possible in many cases. Thus, the determination of thymol, eugenol and methylsalicylate in oils of thyme, cloves and gaultheria were effected. It may be mentioned that the reagents react only with free phenolic hydroxyl groups; no colours, for example, are given by anethol or veratrol.

Detection of Polyphenols

Bezssonov[24] used the corresponding phosphomolybdotungstic acid for the detection of polyphenols. The salt $17WO_3.MoO_3.P_2O_5.H_2O$, was prepared by reacting 44 g. of sodium tungstate with 2.7 g. of phosphomolybdic acid dissolved in 400 ml. of water, and adding to the solution 5 ml. of 80 per cent phosphoric acid and 60 ml. of 5N sulphuric acid.

Monophenols did not react, but hydroquinone gave an intense blue colour, catechol a red-violet colour, and pyrogallol a red-brown colour. Resorcinol and phloroglucinol gave no coloration.

The addition of an acetic acid solution of ammonium molybdate to a solution of an *o*-dihydroxyphenol produces a reddish-brown colour[25]. To 2 ml. of aqueous test solution, are added 0.5 ml. of acetic acid and 1 ml. of 14 per cent ammonium molybdate solution. The test is very sensitive for catechol and pyrogallol, but no coloration is obtained with phenol, resorcinol, hydroquinone, and phloroglucinol.

Sensitivity of Colour Reaction

Platkovskaya[26] examined critically a number of colour reactions of phenols. He found that of phosphomolybdic acid, phosphotungstic acid, Millin's reagent and sodium nitroprusside, the first was the most sensitive; in the presence of ammonia, 1 part in 2,000,000 of phenol itself could be detected. *o*-Cresol gave a similar sensitivity. Compounds of mixed function (e.g., adrenaline, vanillin) as well as α- and β-naphthol gave colour reactions in the presence of ammonia, although they did not react with phosphotungstic acid. Millon's reagent and sodium nitroprusside gave colours with certain phenols only, and did not give colours with compounds of mixed function.

Kisser and Kondo[27] also critically examined a number of colour tests, with the object of identifying small quantities of catechol, resorcinol, hydroquinone, phloroglucinol and pyrogallol. The most satisfactory reagents in their opinion were ferric chloride, titanic sulphate, ceric ammonium nitrate, *p*-diazobenzene-sulphonic acid, Echtrotsaltz B and ammoniacal silver nitrate. They claimed that the reactions with bromine, potassium ferricyanide, sodium tungstate, sodium molybdate, phosphomolybdic acid and ferrous sulphate/tyrosine were not as good.

Nitric acid gives colour reactions with several phenols, which are useful when rapid, but not too sensitive, tests are required[28]. Thus, when 1 or 2 drops of guaiacol are shaken in 10 ml. of water, and treated with 7 drops of concentrated nitric acid, an intense red colour is produced. Cresols give a yellow-orange coloration, as does eugenol; α- and β-naphthol give a brownish coloration, but thymol does not react.

Several workers have detected phenols by means of the characteristic colorations

obtained when phenols are nitrosated. Thus, Ware[29] treated phenols in cold concentrated hydrochloric acid with a mixture of nitrate and nitrite. He used two slightly different techniques:—

(1) 0.05 g. of phenol was dissolved by trituration with 10 ml. of concentrated hydrochloric acid, together with 0.5 g. or more of a mixture of 1 part sodium nitrite, 1 part of sodium nitrate and 2 parts of anhydrous sodium sulphate. The whole was stirred well, allowed to stand for 2-5 minutes, the colour noted, and then 1 ml. of the mixture was poured into an excess of 10 per cent ammonia.

Colours Obtained

Phenol gave a rich crimson colour, which changed to emerald green with ammonia. *o*-Cresol gave a dichroic solution in which green was the more permanent colour. If at this stage, a drop of 40 per cent formaldehyde solution was added, the green changed to blue, and, on pouring into ammonia, an olive-green colour was obtained. *m*- and *p*-cresol gave *no* distinctive tests by such treatment; α- and β-naphthol were coloured purple and purple-violet respectively, in the acid solution, and ammonia destroyed the colour, leaving nothing distinctive. With thymol, the first colour was green, and this became yellow with ammonia.

(2) 0.05 g. of the phenol was triturated with 5-10 ml. of concentrated hydrochloric acid together with a fragment of sodium nitrate crystal. The mixture was heated very carefully until finally the solution boiled. It was then cooled or diluted, and poured into an excess of 10 per cent ammonia. The colour changes on heating and on making ammoniacal were observed. Phenol and *o*- and *m*-cresol gave deep-blue colorations on making ammoniacal but *p*-cresol did not. Guaiacol gave a green colour with ammonia.

Gibbs[30] carried out spectrophotometric investigations of the mechanism of the reactions between nitrous acid, dilute nitric acid and Millon's reagent on phenol. He concluded that the primary reaction of these three reagents with the phenol resulted in the formation of *p*-nitrosophenol, which condensed to form other coloured compounds. The presence of mercury compounds (as in Millon's reagent) accelerated colour formation.

Gibbs[31] also compiled a comprehensive index of the literature on detection of phenols. Although by no means complete, it contained most of the well-known classical procedures.

Steinmetzer[32] was concerned with the microchemical detection of free phenols in essential oils, and made an experimental study of the behaviour of certain reagents towards the more commonly occurring phenols, both alone and in admixture. He showed that addition to the sample of a 10 per cent solution of sodium hydroxide followed by a strong aqueous solution of iodine in potassium iodide yielded an amorphous precipitate, characteristic of the behaviour of eugenol, *iso*-eugenol and thymol, in essential oils and drug sections. The separation of colourless clusters of radiating needles on the addition of sodium hydroxide indicated eugenol. Millon's reagent, while less sensitive, could be made to detect eugenol and *iso*eugenol in oil of cloves. The same is likewise true of alcoholic ferric chloride as reagent for these two phenols, the reactions being characteristic for the oil.

Thymol and carvacrol were detected by means of the violet colour produced on heating with chloroform (the colour appears in the chloroform layer) and a strong solution of sodium hydroxide.

The last test was devised by Flueckiger, who also used potassium hydroxide. Hewitt[33] investigated the mechanism of the reaction, and concluded that the reaction took place in two stages. Thymotinic or carvacrotinic aldehyde is first formed. These combine with the excess of the phenol to form one of the rosolic acid dyestuffs, $CH{\equiv}(C_{10}H_{12}OH)_2$.

Millon Reaction

The Millon reaction has been applied to the detection and determination of phenol in blood[34]. Large quantities of blood must necessarily be used.

Ekkert[35] thoroughly examined sodium nitroprusside as a reagent for phenols. He reported that phenol, cresols, catechol, hydroquinone, pyrogallol, phloroglucinol, thymol and α- and β-naphthol in solution gave different contact-zone colours and different mixed colours, when treated with a reagent composed of 0.02 g. of sodium nitroprusside in 4 ml. of concentrated sulphuric acid. The colours changed on addition of definite amounts of water. Earlier Caseneuve[36] had used a solution composed of 10

ml. of 10 per cent aqueous sodium nitroprusside, 5 ml. of saturated aqueous sodium acetate and 10 ml. of aqueous ammonia as reagent for the detection of resorcinol. The reagent was prepared immediately before use, and the test was as follows: 2-3 ml. of the reagent were placed in a test-tube, and several drops of aqueous resorcinol test solution or a few particles of the solid material added. On agitation a green or bluish-green colour developed rapidly. About 0.5 mg. of resorcinol could be detected in this way, and Caseneuve claimed that other phenols did not give the reaction. Presumably, the above conditions rendered the reaction specific or, at least, highly selective.

Hydroquinone gives a blue colour with cupric ions. Aloy and Valdiguie[37] found that the reaction was more sensitive than the reaction between cupric ions and ammonia; 0.1 mg. of hydroquinone could be detected. α-Naphthol gave a blue-violet colour under the conditions used, enabling a distinction to be made from β-naphthol which did not react.

Another useful test for individual phenols was described by Levine[38]. He used as reagent a 0.5 per cent solution of selenium dioxide or, a 0.75 per cent solution of sodium selenite, in concentrated sulphuric acid. Green or blue colours were obtained with numerous phenols, including phenols of mixed function.

An inorganic reagent, composed of potassium ferrocyanide in presence of ferric chloride, has been used[39] with success as a very sensitive test for *o*- and *p*-polyphenols. The reaction involves a reduction of the reagent with formation of molybdenum blue.

A Reducing Phenol

Hydroquinone is a reducing phenol and will reduce both silver nitrate (giving a precipitate of metallic silver) and Fehling's solution, which precipitates cuprous oxide after 24 hours. Reporting these reactions, Messner[40] pointed out that catechol behaved similarly, thus making a differentiation between the two phenols impossible.

Traces of resorcinol may be detected by the Carrobio[41] reaction, based upon the formation of a blue coloration at the interface of ethereal solution of resorcinol and an ammoniacal solution of zinc chloride. Bey[42] studied the effect of replacing the zinc with other cations, and found that, using cadmium the test could be made eight times more sensitive.

Ekkert[43] used a solution of antimony pentachloride as a general test for phenols. Individual phenols gave characteristic colours. Thus, in the cresol group *o*-cresol gives a rusty brown colour, *m*-cresol orange-red, and *p*-cresol red-brown.

Detection of Resorcinol

Resorcinol may be detected in presence of relatively large quantities of catechol and hydroquinone by its reaction with an ammoniacal cobalt solution[44]. 1 ml. of a solution containing 1 per cent of resorcinol is treated in a Nessler tube with 1 ml. of a cobaltous chloride solution (0.4 mg. Co++/ml.), 0.3 ml. of concentrated aqueous ammonia, 3 ml. of ethanol and water to make 50 ml. The tube is stoppered and allowed to stand for five minutes. A deep green coloration is produced, which is not obscured by the brownish colours given by catechol and hydroquinone.

Liberalli[45] showed that when a few drops of a 10 per cent alkaline thiocyanate and 1 ml. of concentrated sulphuric acid are added to crystals of resorcinol, pyrogallol, phloroglucinol, thymol or α- and β-naphthol, colours appear, which become more intense in a boiling water-bath. The colours are due to condensation products between the formic acid (produced during the reaction) and the polyphenol. The colours obtained are respectively orange-red, carmine, yellow turning to orange, rose-salmon and emerald green.

Mesnard[46] has proposed several colour tests for resorcinol based on its reaction with ammonia. If crystals of resorcinol are exposed to the action of ammonia in the presence of water vapour, they gradually deliquesce, and in about 40 minutes they assume a blue tint. If aqueous ammonia is added to a solution of resorcinol, various colorations appear, even in the cold. On heating on a water-bath, deeper colours are obtained. Blue colours are eventually obtained, which are not given by other phenols. The reaction is useful for the detection of resorcinol in various commercial preparations.

Physico-Chemical Methods

Several physico-chemical phenol identification methods have been proposed, based on the melting point determination of deriva-

tives. These melting points are, of course, characteristic for a particular phenol.

Reid[47] reacted *p*-nitrobenzylbromide with phenols to form crystalline *p*-nitrobenzyl ethers with definite melting points. In this way, he identified phenol, the three cresols, thymol, eugenol and vanillin. Kao *et al.*[48] formed *p*-chlorophenylurethanes of definite melting point by reacting *p*-chlorobenzazide with phenols in boiling toluene. Phenol, the three cresols, thymol and α- and β-naphthols could easily be identified. Sah and Ma[49] similarly reacted phenols with 3,5-dinitrobenzazide to form 3,5-dinitrophenylurethanes.

Infra-Red Technique

Whiffen and Thompson[50] have developed an infra-red technique for the detection and determination of cresols. They gave the absorption spectra of the three isomeric cresols over the range 700-1,300 cm^{-1}. Each isomer had an intense absorption band in the region between 1,200 and 1,300 cm^{-1}. The former band was characteristic of benzenoid substances with substituents attached to the nucleus. There was a shift of this aromatic band towards higher frequencies in passing along the series *o-m-p*. With the cresols, this is found at 750, 776 and 815 cm^{-1}, respectively. When a qualitative analysis only was required, inspection of the spectrum of a mixture at once revealed whether peaks were present at the wavelengths characteristic for each component. The amount of a component could be correlated with the percentage absorption at its key wavelength. The technique also proved of value for the detection of small amounts of phenol in cresol, by means of its band at 1,070 cm^{-1}.

Extension of this important technique should form the basis of a general method of characterisation.

Miscellaneous

Klingstedt and Sundstrom[51] formed the methyl and ethyl ethers of thymol, which under suitable conditions were easily nitrosated. This afforded a means of detecting thymol in the presence of carvacrol, which, with like treatment, failed to yield a nitroso derivative.

The methyl ether was dissolved in ethanol and acetic acid, and the solution saturated with hydrogen chloride. Addition of aqueous sodium nitrite then gave a precipitate of nitrosothymol.

Finally, mention may be made of two most useful critical reviews of methods for the detection of phenols. Seguin[52] examined colour tests in current use with a view to identifying certain of the phenols which normally occurred in medicine. He concluded that text-books on the subject gave the impression that the common colour tests were obtained only with comparatively few phenols, whereas, as a matter of fact, they were common to most.

Contzen[53] investigated 11 reagents recommended by Merck in 1908 for detecting phenols. All failed to detect less than 1 mg. of phenol/ml. Landolt's test with bromine, whereby a turbidity of tribromophenol is formed, and Udromsky's test with furfural and sulphuric acid served to detect 0.1 mg. of phenol.

Although an enormous amount of research has been done on the detection of phenols, there is still a definite need for rapid, more sensitive and specific tests (preferably colorimetric) for most phenols.

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American Chemical Industry

Remarkable Growth of Vast Organisation

AN alarming decrease in the number of trained men and a drive to try and eliminate the accrediting of universities and colleges by professional societies in the U.S.A. was revealed by Dr. Richard L. Kenyon in his interesting paper on 'The Organisation of the American Chemical Industry,' delivered to a meeting of the London and South-Eastern Counties Section of the Royal Institute of Chemistry on 20 February.

Dr. Kenyon, who is associate editor of the American Chemical Society's *Chemical and Engineering News* and *Industrial & Engineering Chemistry* came to Europe in October, 1950, and has had an office in London since February last year, where he has done much useful work as a liaison officer between chemical interests in the U.S.A. and Britain in aiding the better propagation of ideas and by furthering the interchange of scientific and factual information.

To attempt any full description of the American chemical profession in a short address was obviously almost impossible, began Dr. Kenyon. Some idea of the general framework could, however, be given through a summary of the main professional organisations, educational practices and some comments on the industry.

Industry's Startling Growth

Since the beginning of the last war the American chemical industry had experienced remarkable growth at an increasing rate. In 1951 the chemical processing industry was one of the three industries investing the greatest amount of capital expansion in the U.S.A. One major chemical company invested $100,000,000 in expansion in 1951 and has averaged about $60,000,000 in the past five years. It expects that demand for its products will exceed its productive capacity before the end of this year. This company increased its sales nearly 1,200 per cent between 1939 and 1951, but firms have increased their sales by 300 per cent during the last 10 years.

The heart and centre of the chemical profession in the U.S.A. was the American Chemical Society. Founded in 1876, it had grown constantly, particularly in the last 10 years, and now had more than 67,000 members. With its expansion there was a demand for more specialised service. This was met by the creation of divisions within the society beginning with organic chemistry, industrial and engineering chemistry, and a few others. This process was continued and there are now 20 divisions.

The Society's Work

More important work of the ACS included standardisation of nomenclature, specifications, and apparatus. Sponsorship of meetings was a major project, two annual meetings being held each year. When the average attendance at these meetings passed 7,500, with a peak of 11,000 it was decided that they had become too large. Experiments were now being tried out with divided meetings, but so far no really satisfactory solution had been arrived at. Divisions also sponsored meetings for symposia in their own field, while an increasing number of gatherings of from one to three days duration were organised by local sections at which chemists in the vicinity were given the opportunity of presenting papers.

In matters of public policy the ACS had taken an active part, one of its most important legislative efforts being an insistance that technical men should not be included in heterogeneous labour unions.

Publications were, of course, one of the largest activities of the society. Through its journals members received more than 1,000,000 words published in 1951. An important and growing section of the editorial work was the ACS New Service. All information on technical papers, activities of the society and its sections had to be released through the service. As a result there had been greater accuracy in reports, a manifold increase in newspaper publication on chemical subjects, better public understanding of the chemical profession and its work, and the chemist was more highly esteemed.

Other professional organisations included the American Institute of Chemical Engineers, limited to those whose training and experience qualified them to co-operate with engineers in the advancement of chemical engineering knowledge and practice. While

smaller than the ACS, its activities were similar, including publications, professional standards and accrediting of training curricula.

The American Institute of Chemists, established in 1923, now had a membership of about 2,500. Its aims were to maintain a high code of ethics for chemists and to give attention to the economic status of the profession.

An entirely industrial group, in which the membership was composed of companies, was the Manufacturing Chemists' Association. This attempted to aid problems of industry through committees which included air and water pollution abatement, chemicals in food, tariffs, patents, safety, metal packages, and so on. The Synthetic Organic Chemical Manufacturers' Association was a similar organisation, but more restricted in scope.

Training Programmes

In order to keep the level of the chemical profession high a sound basic education is necessary. To ensure this, both the ACS and A.I.Chem.E. have taken an active part in accrediting training programmes. Examination is made of the systems of universities and colleges granting degrees in chemistry. No fee is charged and no set curricula are demanded. Accrediting of a college or university means that its graduates in chemistry are eligible automatically to become senior members of the ACS after two years professional practice. No effort is made to bar the employment of men graduating from non-accredited schools.

During last year a group called the National Commission on Accrediting was formed by a group of academic leaders, which has undertaken to try and eliminate accrediting by professional societies. It has established its own organisation to accredit schools on an institution-wide basis. The ACS, to give the new organisation a chance, has agreed to withhold accrediting activities during the remainder of the academic year. It maintains, however, that accrediting in a professional field is better judged by men in that field, and that accrediting should be relative to a department and not a whole university. It remains to be convinced that teachers can do this better than chemists.

In many American universities professors are encouraged to do regular industrial consultation as this helps them to keep in touch with practical work and thereby improves their value as teachers. On the other hand some industrial firms have an active policy of giving a limited number of their research workers the opportunity of a year to do university teaching or research to freshen their approach to their work.

What becomes of chemists and chemical engineers after graduation? It is becoming increasingly appreciated, said Dr. Kenyon, that the abilities of the chemist can be widely used, and he should not, as has too often been the case in the past, be confined to the laboratory, plant, or academic work. This was noticeable in the striking increase in the number of chemically trained men in executive ranks. A recent survey of 100 chemical processing companies showed that nearly 85 per cent of the executive promotions in 1951 went to technical graduates.

A number of graphs were shown comparing the salaries of B.S. and Ph.D. degrees, and also demonstrating that although Government chemists started at levels comparable with others, after a few years their salaries were lower. This had caused considerable complaint in recent years, as it was pointed out that the Government cannot expect to retain its most capable men on the poor salaries offered.

There was nothing in America comparable to the DSIR in Britain. A small beginning might be under way in the National Science Foundation, but this had suffered a setback as its appropriations, anticipated at $14,000,000, had been reduced to $3,500,000.

Trained Men Deficiency

A very serious problem was the increase in research and expansion of industry and the constant decrease of trained men, which was causing much concern. This was partly caused by the drafting of men into the army which caused doubt and indecision as to future careers So far no practical solution seemed to have been evolved.

Expansion of the American chemical industry was illustrated by a number of examples. Greatest expansion within this industry in 1950 was in synthetic fibres, insecticides, and fungicides.

Perhaps the greatest development of a single broad trend was in the use of petroleum products as raw materials. It had been estimated that the U.S.A. was now dependent on petroleum for about one quarter of all her chemicals made.

Training the Chemical Technologist

Conference Held at Bradford

A CONFERENCE on the training of the chemical technologist was held at Bradford Technical College on 16 February by Bradford Chemical Society with the co-operation of the West Riding Section of the Society of Dyers and Colourists and Leeds Metallurgical Society. The Conference was held in two sessions, in the first of which representatives of industry spoke on the training of the dyer, textile chemist, chemical engineer and metallurgist. In the second session teachers of these technological subjects gave their views.

The chair was taken by Mr. H. Richardson, Principal of Bradford Technical College, who referred to the wide and representative nature of the meeting. For the purpose of the conference, technologist was defined as one who had received training in a branch of chemical technology which was equivalent to that received by a student of pure chemistry for a degree or equivalent qualification. Various professional associations, the Anglo-American Productivity Council and the recent Government White Paper had all stressed the importance of technology. The function of the chemical technologist was particularly important and the proper training of the technologist could mean much to chemical industry.

Personality Important

Mr. G. B. Angus, a director of Messrs. John Crossley, speaking on the training of the dyer from the industrial point of view, considered that the dyer should have both an adequate technical knowledge and the ability to impart and use that knowledge. He thought that a knowledge of management was important and that it was not a subject which lent itself to teaching in colleges, depending rather on personality. He felt that teaching institutions should put more emphasis on practical work. Since dyers spent much time with machinery a basic knowledge of its principles and maintenance should be taught.

Mr. W. L. Thomas, Chief Chemist, Messrs. Woolcombers, Ltd., speaking for employers on the training of the textile chemist, emphasised the necessity in the textile industry for chemists at all levels of training. It was essential to combine practical works experience with technical training. It was very desirable that training should include some teaching of such extra-laboratory topics as costing, market reports, and the work of other departments. The technologist must be trained to express himself intelligently and concisely, both orally and in writing.

Mr. G. W. Green, president of Leeds Metallurgical Society, considered that some introduction into the works during the college training of the metallurgist was necessary. He also emphasised the necessity of some knowledge of industrial administration.

Degree Standard Necessary

Mr. Trefor Davies, Director, Messrs. Bantam Products, said that the chemical engineer required a full university training to degree standard in chemistry, physics and mathematics, followed by training in engineering, drawing, layout and plant design. It was important that training should be in the university atmosphere where close contact with men training for other professions could develop a broad outlook. Vacation work in industry was as important as work on small-scale plants in the university.

In the discussion following the first session Mr. Bird, Lecturer in Dyeing, Leeds University, suggested that when introduced into industry the young chemist should spend some time in the actual factory. He himself had spent some time in this way in a dye-house and had learnt to appreciate the workers and their problems. Dr. Happey, Head of Textile Department, Bradford Technical College, thought that new graduates should enter industry as shift chemists and then rise to higher positions. Other speakers felt that teaching in colleges should not be too theoretical in character and that it was doubtful if the addition of subjects such as management to an already large syllabus was wise.

Opening the second session, Mr. A. W. Doyle, Ministry of Education, pointed out that it was necessary to distinguish between training and education, the first being the function of industry, the second that of teaching institutions. Mr. Doyle laid stress on the need for teachers to keep themselves

abreast of modern developments. The Ministry of Education encouraged research and the release of teachers to industry for short periods.

Dr. R. L. Elliott, Head of the Department of Chemistry and Dyeing, Bradford Technical College, speaking on the training of the dyer and textile chemist, said that for the adequate absorption of the new science of high polymers into the dyeing and textile industries both primary and secondary technologists were required. The former required a fundamental knowledge of chemistry, physics and mathematics, followed by more specialised advanced study and a general survey of the particular industry concerned. He felt that a full-time university training was incompatible with the tempo and mental outlook of industry.

Works Visits Desirable

Works visits and vacation courses in industry would acclimatise the primary technologist to the industrial atmosphere. The secondary technologist should have preliminary chemistry, physics and mathematics to Intermediate degree level. This should be followed by four years part-time study. Teachers must have good industrial experience and be progressive in outlook. Greater freedom of access of teachers to industry was necessary and a greater tendency of industry to treat the teacher as a teacher rather than the operator of a production line.

Mr. K. L. Butcher, Senior Lecturer in Chemical Engineering, Bradford Technical College said that the student chemical engineer needed to follow a course similar to that for a university degree in a technological subject or to those conducted for the training of engineers. Less outstanding aspirants should follow the route of the National Certificate to graduate and Associate membership of the Institute of Chemical Engineers. One or two year full-time courses were available for chemists or engineers to qualify in chemical engineering.

Dr. N. K. Petch, Lecturer in Metallurgy, Leeds University, distinguished between the research worker or investigator of scientific problems in technology and the managerial type of technologist. For the former a university degree followed by some training in the technology were required. It had been suggested that for the managerial type of technologist a 'liberal' education was necessary, including some cultural subjects. He thought it better to rely on the contacts within a college for cultural development, together with some directed reading, rather than on formal lectures. He felt, however, that there was a strong case for the inclusion of such subjects as industrial administration, economics and finance as well as some engineering training.

In the discussion following the second session much comment was made on the suggestion that teachers should enter industry for short periods. Several speakers from the industrial side thought that little would be gained by this, and one speaker suggested that teachers might rather enter research associations, though Dr. Elliott said that the research associations suffered from the same handicaps as the teaching institutions, the atmosphere differing from that of industry. Other speakers emphasised the necessity for the inclusion of some knowledge of industrial administration and allied subjects in the training of the chemical technologist.

Leeds University Gifts

FURTHER gifts to Leeds University were acknowledged by the council on 20 February, as follows:

Department of biomolecular structure: £3,000 over two years for infra-red research from the Nuffield Foundation.

Inorganic and physical chemistry department: £700 from the Anglo-Iranian Co., Ltd., for research by Professor Dainton; £600 from Monsanto Chemicals, Ltd., for 1951-52; 100 gns. from Ricardo and Co., Ltd., in recognition of help given by Dr. Walsh.

For the purchase of an ultra-centrifuge from the U.S.A., £6,000 from the Wool Textile Research Council to the department of textile industries; £250 for research from the Anglo-Iranian Oil Co., Ltd.

Colour chemistry and dyeing department: £350 from the Wool Textile Research Council for materials and equipment.

From Imperial Chemical Industries, Ltd., £200 for research to the department of coal, gas, and fuel industries, and £10 to the department of mining for the mining prize in 1952.

Rheumatism research: 10 gns. from the Bank of England.

Accidents & Industrial Diseases in 1950

Report of Chief Inspector of Factories

ACCIDENTS in the chemical and allied trades have for a number of years been kept at a consistently low figure. This is no doubt largely due to the fact that both employers and workers are fully aware of the hazards of the materials with which, in many instances, they have to work.

An example of a well thought-out scheme of educational propaganda in the case of eye protection is given in the 'Annual Report of the Chief Inspector of Factories for the Year 1950,' published on 21 February (HMSO, 6s. 6d. net., Command 8445).

As a result of the campaign employees in a chemical works became more conscious of the dangers and some of them pointed out to the Safety Officer that the goggles provided did not protect their faces while working with corrosive liquid which was liable to splash. They were forthwith supplied with PVC headpieces, with visors to protect the whole of the face to be used whenever splashing might be expected.

In another chemical works a circular letter on eye protection was sent to all departmental managers. Every worker who at any time might be exposed to eye injury from strong acids or corrosive liquids, was issued with a pair of goggles for which he signed. Each man was also given a leaflet setting out his responsibilities and any man found not using his goggles was admonished.

Spattered Goggles Exhibited

Several goggles badly spattered with molten caustic have been preserved in one works for exhibition. In each case it is probable that blindness would have resulted if goggles had not been worn.

Among the few accidents at chemical works recorded in the report was one in the section devoted to faulty operational design of machinery or plant.

At a naphthalene melting tank, material was fed into the tank by means of a rise and fall bell fitting into an orifice. The bell was kept in its sealed position by a counterweight arm, the end of which reached nearly to the floor. When large pieces of material caused a blockage, it was sometimes necessary for the attendant to lift the end of the counterweight arm and depress it sharply, and on one occasion he dropped the arm on to his foot and caused severe toe injury. The end of the counterweight arm was subsequently cut off, and a suitable handle provided to raise the bell.

Dangers of too easy access to hazardous materials were illustrated by the case of a 17-year old boy employed at a paint works, who obtained some red phosphorus and sodium chlorate from the laboratory. When he began to grind them in a mortar there was an explosion and his face and eyes were badly burned.

An examination of the incidence of fatal cases of lead poisoning was included in the section of the report on industrial diseases.

Of the 57 cases of lead poisoning reported during the year none was fatal. This was the first time since lead poisoning became notifiable that there had been no fatal case.

Beryllium Under Scrutiny

In view of the American experience of the action of beryllium in causing acute pneumonitis and pulmonary granulomatosis conditions under which it was extracted and used had been carefully watched and particular attention directed to dust control. One fatal case of pulmonary granulomatosis and a case of acute pneumonitis with recovery had been recorded.

A fire occurred in a boiler where a mixture of 70 per cent diphenyl with 30 per cent diphenyl oxide was used instead of water. The mixture has a boiling point of 255° C. and was used in a closed circuit to heat autoclaves. One man was overcome by the fumes. Two days after the accident he was restless and jumpy, but thereafter his condition improved steadily. From this case it appeared that diphenyl vapour seems to act mainly on the central nervous system and as an irritant of the respiratory system.

Three cases of mercurial poisoning were reported in 1950. There were six cases of aniline poisoning, the lowest figure ever reported. Forty-six cases of compressed air illness were notified, the same number as in 1949, which was the highest hitherto reported.

Notifications of industrial dermatitis totalled 3,579, a decrease of 38 on the previous year. No age group appeared to be immune.

Recent Advances in Crystallography

Professor Kathleen Lonsdale's Lecture to RIC

CRYSTAL investigations and their possible technological applications were discussed by Professor Kathleen Lonsdale in a lecture, illustrated with lantern slides, delivered to a meeting of the London and South-Eastern Counties Section of the Royal Institute of Chemistry held in London on 16 January.

The Scope of Crystallography

Modern crystallography, said Professor Lonsdale, was concerned with problems of crystal morphology, texture, atomic and molecular arrangements, atomic vibrations and fields of force, in relation to physical and chemical behaviour. Chemical crystallography dealt especially with identification and analysis of solids, the stereochemistry of molecules and their accurate dimensions, the nature of bonds and ionic co-ordination, the course of chemical reactions, especially those occurring in the solid state, or of which the beginning and end products were solids.

Great advances had recently been made in the exact stereochemistry of moderately complex molecules such as those of calciferol, strychnine, penicillin, camphor, and so on, by the use of heavy atom techniques and comparison of isomorphous series. Structure analysis had given a new meaning to the word 'isomorphism' by the extension of the term to include structurally similar atomic and molecular arrangements.

The Fourier analysis of crystalline substances such as coronene had given accurate values of bond lengths and angles for comparison with quantum mechanical calculations, and many quite simple structures, such as that of maleic acid, showed points of great interest and had only recently been investigated, because they had to be analysed by the difficult process of trial and error.

Absolute Configuration

It had recently proved possible to determine the absolute configuration of an optically active compound and to show that the Fischer convention was correct.

Various derivatives of cyclohexane had been studied and it had been shown that the ring, which only occurred in the chair form, could be distorted considerably, if necessary, to avoid the too close approach of substituent atoms. Magnetic measurements of principal susceptibilities could assist markedly in the problem of structure analysis. It was also possible by crystal investigations to follow the course of chemical reactions.

One interesting, and very simple, investigation recently carried out on lithium hydride had shown that the atoms were not fully ionised and that probably the correct formula was near

$$\underset{\text{Li}}{+\tfrac{1}{4}}\ \underset{\text{H}}{-\tfrac{1}{4}}$$

In general, hydrogen could not be located by X-ray methods because of its feeble scattering power in organic compounds, but recently more refined methods of Fourier analysis had shown electron density contours which corresponded to hydrogen atoms. Electron diffraction methods had also been improved to give Fourier patterns of the crystal potential and here again the hydrogen positions could be identified.

Neutron Diffraction

Development of neutron diffraction methods made the problem much more manageable, and these had thrown light on the difficult question as to where the hydrogen atoms were in ice crystals. The structure of ice showed a certain randomness which was now being recognised as a not uncommon feature of many otherwise simple structures: decaborane, $B_{10}H_{14}$, proved more difficult to analyse than might have been expected, partly because of a randomness of its structure.

Finally, H. M. Powell's 'Clathrate' structures, which included crystalline compounds of the rare gases with organic complexes, had been shown to be one form of molecular compound which existed only in the solid state, and which might have important technological applications.

At the close of the lecture, Professor Lonsdale answered questions put to her by members of the audience on the calculations involved in preparing Fourier maps, defect structures, phosphors and magnesium oxide.

Diagnosis of Gassing Casualties

ABCM Scheme for Labelling Hospital Cases

FOR some considerable time the Works Safety Committee of the Association of British Chemical Manufacturers has felt that an important contribution to industrial safety would be made if hospitals could have a correct history and diagnosis of cases of gassing sent from chemical works, in order that the appropriate treatment might be instituted without delay. The comparative rarity of the cases, and to a lesser extent the variety of the causative agents, have sometmes resulted in delay in exact diagnosis, and, therefore, in selecting appropriate treatment, while certain casualties require rather specialised treatment.

It was thought that if some system could be devised whereby casualties caused by some of the more common gases could have suitable labels or cards sent with them to hospital, setting out details of the first aid treatment they had already received, and suggesting further treatment, many of these difficulties could be overcome.

A panel composed mainly of industrial medical officers was therefore appointed to investigate the whole matter. As a result of their deliberations, a series of labels has been evolved. The council of the association has welcomed the scheme and has recommended all members who may at any time have gassing casualties to institute this system.

In view of the importance of this matter it was decided to make the information available to a wider circle by issuing it in the form of a booklet, and offering this booklet and labels for purchase by manufacturers and users of chemicals likely to encounter these risks.

Hospitals Support Scheme

Medical members of the panel which drew up the wording for the labels have sought the opinion of a number of hospital medical officers and have been assured that the scheme will be welcomed by the hospitals, provided it is introduced by consultation and discussion beforehand and not simply applied to the first casualty which occurs.

In addition to personal data regarding the patient and details of the exposure, each label contains three sections:—

1. First Aid Treatment—which acts as a reminder to first aiders as well as informing the hospital about the action already taken;

2. Immediate Treatment Recommended—which sets out the treatment which may be applied in the works surgery, if sufficiently skilled staff is available, or should be given immediately on arrival at the hospital;

3. Subsequent Treatment Recommended—which sets out the treatment which may be required when the immediate distress has subsided, and which may not need to be applied until some time after the casualty has been admitted to hospital or reached home.

Requires Signature

The label requires signature, and it is recommended that it should be signed by the Industrial Medical Officer or nurse where possible, and failing either of them, by the first aider.

Apart from the more serious cases which are sent to hospital, the labels may also have a useful field of application where lightly gassed casualties are sent to their homes. Managements may wish to consider means of using the labels to forewarn the patient's own doctor in such cases.

Special attention is drawn to those gases, for example, hydrogen cyanide, where specific antidotes of a particular strength or of an unusual nature are required immediately. It is urged that these should be made up or obtained beforehand and kept ready for use in factory and hospital. Some firms, in fact, have found it worth while to have a small kit of such antidotes prepared and kept ready.

Copies of the booklet 3s. post paid (75 cents, U.S.A.) cash with order, may be obtained from the Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1. The labels themselves may be purchased, ready for use, by quoting the appropriate letter, as shown in the index to the booklet. Price of the labels is 2s. a dozen (50 cents, U.S.A.), cash with order. It is pointed out that these can only be supplied in minimum quantities of one dozen.

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Metallurgical Section

Powder Metallurgy

A Review of the Literature and Recent Russian Work

THE literature on this subject continues to grow rapidly, and may be regarded as a measure of its importance and interest, and of the considerable research undertaken both from the engineering and general scientific standpoints. In Russia, too, several articles have been lately published, but it cannot be said that their quality indicates a higher tempo of advance than that of Western Europe or America. A brief note of the contents of two of them is appended at the end of this article.

A comprehensive survey on powder metallurgy has just appeared in *Angew Chem.*, 1952, **64** (2), 41-54, in two parts: (i) Technical and economic, by R. Kieffer (48 references); (ii) Scientific and theoretical, by G. F. Hüttig (36 references); based on papers read at the meeting of the German Chemical Society, Cologne, 26 September, 1951.

(i) Dr. Kieffer notes in the first place the two different kinds of chemical industry, namely that established on purely scientific grounds at the start, such as the dyestuffs, electrochemical and some others; and that founded empirically on a practical basis at first, on which scientific research has subsequently focussed its beam, such as cement, glass, sugar manufacture, etc., and, more recently, powdered metals. He traverses the familiar ground covered by numerous compilations (books and periodicals) such as those of Skaupy, Jones, Kieffer, and others, various conferences and symposia, and numerous articles.

Principal Uses

Principal uses to-day are not so much for the sintered and compressed products as for the powdered metals themselves (Al, Cu, Zn Mg, Fe, brass and bronze) in paints, anti-corrosives, and in chemical and pyrotechnic fields. Yet there is a wide and growing demand for porous and also for dense sintered products in many directions, e.g., for bearings, filters, etc. For example, the Moraine Division of General Motors and the Amplex Division of the Chrysler Corp., use 800-1,000 tons of bronze and iron powders per month. In 1951 total world consumption of iron and copper powder was about 30,000 tons, and may increase this year to 50,000 tons, by far the largest consumer being the U.S.A. Even this figure is below the peak reached during the war. To meet the rising demand for iron powder new plants have been built in Sweden and the U.S.A. of about 5,000 tons per annum capacity each, and should be in operation this year.

Liquid Iron Melts

On the production side special interest attaches to the atomising of liquid iron melts, for instance, in the Naeser method (*Stahl. u. Eisen*, 1950, **70**, 995-1004) for the direct manufacture of strip, sheet, and other iron semi-fabricates from powder, also including bimetallic products. This opens up a wide and varied field. Recent developments in the U.S.A. in respect of the rarer metals, uranium, titanium, zirconium, vanadium, including the new works belonging to the Titanium Metals Corporation of America, are also noted. The latter's output will be about 4,000 tons of titanium per annum. While European research has achieved much in this field, its translation into commercial production has lagged behind the U.S.A. In this connection reference should be made, for example, to the Kroll process for obtaining titanium and zirconium, and uranium, by reduction of their chlorides with Mg or Ca.

Turning now to sintered products, the metals molybdenum and tungsten were, until lately, produced almost entirely by the Coolidge method, but during the past two or three years the Climax process using molybdenum powder is being increasingly used: a combination of powder metallurgy and smelting, including de-oxidation with carbon black, whereby bars and ingots up to

1,000 kilos in weight are obtained. Similar methods are used for tungsten (B. Goodwin *et al., Metal Prog.*, 1951, **59**, 812). A method has been introduced for protecting these metals from oxidation, that is, at temperatures over approximately 500°C., by siliciding, using a silicon tetrachloride/hydrogen mixture. Work in this direction has been described by I. E. Campbell *et al.* in *J. Electrochem. Soc.*, 1949, **96**, 318; 1951, **98**, 21; and by R. Kieffer, Heraeus Festsch, 1950, 186-205).

Hard Metals Research

However, it is probably in the field of metal carbides, or so-called hard metals, that some of the most interesting research with metal powders has been undertaken, and the literature is somewhat prolific. More particularly it relates to carbides of W, Ti, Ta, Nb, and V; and to mixtures of two or more of these, especially the ternary systems WC-TiC-TaC, etc. While carbides of the 4th and 5th groups, except possibly VC-ZrC, are readily miscible, those of the 6th only dissolve small amounts of other group carbides at extremely high temperatures. (Ref. to work of Norton, Mowry. Kieffer and several others). Other important developments are the combination of these carbides with bonding metals, Co, Ni, Ni-Cr, etc., that have proved particularly valuable in the high-temperature requirements of turbines, jet engines and so on.

Yet other valuable and interesting groups comprise the metal borides, especially the di-borides of Ti and Zr; and the silicides. Twenty or thirty combinations in both groups have been prepared, and the study of their properties forms a wide and most interesting programme of current research. Kieffer and Cerwenka have tested the high-temperature behaviour (incandescence) of several pressure-sintered Mo-Si alloys at 1,500°C. in air for 4½ hours, of which an illustration is given in original, and details will shortly be published in *Zeit. Metallkunde.*

The value of porous sintered products in many fields, especially for bearings, was soon realised in the early days of powder metallurgy, and improvements are constantly being effected. J Haller has lately described the introduction in the U.S.A. of sintered material of unusually large oil absorption capacity (*Materials and Methods*, 1951, **33** (5), 80-81). One method is to incorporate organic material or low-melting metal with the powder mix, and this is subsequently burnt or melted out leaving a highly porous skeleton.

Other important uses of sintered porous material were described in the 1947 metal powder symposium (Iron & Steel Inst.) and in the 1951 symposium on high-temperature steel and alloys (Iron & Steel Inst.). A wide and rapidly extending field for sintered metal powder products is, of course, in the fabrication of machine and apparatus parts to practically finished dimensions, in iron, steel, and bronze. This has been extended not only to ordinary carbon steel but to many special steels and alloys, as Kieffer and co-workers have described in *Berg- u.Hüttenmänn. Mh.*, 1949, **94**, 284-294; 1950, **95**, 145-150; 1951, **96**, 184-7).

(ii) Powder metallurgy has further stimulated many departments of research already important in other fields, e.g., the nature and properties of material in a finely powdered form, particles size distribution and its significance; the numerous comminuting processes and their relative efficiency, and so forth. Professor Hüttig (of the Inst. Anorg & Phys. Chem., Graz—now a familiar name in the annals of powder metallurgy) emphasises the supreme importance of size, form, surface structure and interior qualities of grains or particles, and how widely these may vary in the same metal powder obtained by any one of the many different methods of production. This is illustrated in the case of iron powder obtained by grinding (Hametag or Eddy mill) the carbonyl method, and electrolytically. For many purposes it is sufficient to know only the average fineness or particle size; but a more precise specification involves weight distribution of particle sizes, or frequency curves, of which three sets are shown and discussed.

Methods of Production

Among the various methods of producing metal powders, chemical and mechanical. the latter, despite their wide and varied application in industry generally, have been studied hitherto mainly from the empirical standpoint; and in the author's view the fundamental physico-chemical problems involved have been largely neglected. Among the relatively few who have contributed to basic knowledge may be mentioned A. Smekal and his work on cohesion and brittleness dating back to 1933. More

recently (in 1951) A. Langer has done some interesting work in grinding glass with steel balls of varying size, and correlating powder characteristics with grinding conditions.

Pressure distribution in compressed powders has perhaps been more fundamentally investigated, by R. P. Seelig, P. Duwez and L. Zwell (measurement of lateral pressure) and others, and by C. Ballhausen, who established inner and outer conformities and equations relating force P with various factors of applied pressure, including friction coefficients.

The course of the actual sintering process is considered at some length, beginning with the distinction between pressed and unpressed powders, and the rôle of adhesion, surface diffiusion, and lattice diffusion as shown in curves using the Tammann temperature quotient (alpha) or T/T_s (where T is the observed (*betrachtete*) temperature and T_s the melting temperature, both in absolute units), and ranging in this case from about 0.2 to 0.4. Some important work on sintering has been published by G. C. Kuczynski and B. H. Alexander in 'The Physics of Powder Metallurgy' 1951 (W. E. Kingston). Other sections in this comprehensive and authoritative survey, which there is space only to mention, relate to properties and their correlations in sintered bodies, sintering processes with two metals, and saturation methods.

Recent Russian Work

Regarding the recent Russian work on powder metallurgy, the first paper to be noted here is that by I. M. Fedorchenko (*Izvest. Akad. Nauk. SSSR*, Otdel. Tekhn. Nauk, 1951 (3), 411-418) dealing with the specific surface of metal powders, or absolute size and surface behaviour; on one aspect of which he cannot find any references in the literature, namely, the effect of methods of production. He aims to fill this lacuna, and considers it largely due to the difficulty of determining specific surface by the only method hitherto available—nitrogen adsorption. A new method and apparatus are described, as proposed by B. Deryagin and co-workers (*Doklad. Akad. Nauk SSSR*, 1948, **61** (4)) based on measurement of the permeability of a porous body to gas under conditions of Knudsen flow. An equation is derived for S (specific surface) in terms of molecules of gas flowing, pressure gradients and other factors. Powders tested by this method included tempered and untempered iron (Hametag, electrolytic carbonyl), copper, and nickel.

Reliable Results

The author's general conclusions are that the method used gave reliable and reproducible results; values of specific surface were determined by particle size and method of production; in the powders studied variations of specific surface ranged from 0.151 to 0.0017 $m^2/g.$; the maximum values for specific surface were obtained with powders produced by the low temperature carbonyl method, by the eddy (Hametag) process, and by electrolysis; in the case of Hametag (iron) powders the relation between specific surface and particle size may be expressed by empirical formulæ, permitting it to be calculated both for an individual fraction and a mixture of several; calculations of the value of surface roughness coefficients show the relation of these to particle size and to the nature of the metal. (The work was undertaken at the Inst. Metallurgii im. A. A. Baikov, Akad. Nauk SSSR.; no literature references, except to the article by Deryagin *et al.*).

A two-way or duplex method of pressing powdered material is described by I. A. Leskovich (*ibid.* (8), 1230-1233), and relates to powders generally, including those of metal. Here again the author notes a serious lack of published work: he quotes, as is often the case nowadays, only a few Russian references. It is a little curious that the graphs shown relating density of powder to various factors refer solely to *p*-$C_6H_4Br_2$ (*para*-dibromobenzene), although this material, powdered or otherwise, is not mentioned in the text. In the author's view it is not possible to limit oneself solely to earlier work in powder metallurgy, manufacture of ceramics, and compressing generally. New experimental data are required both in regard to the mechanical and other factors involved, and to the properties of the finished product. The principal Russian work on powder metallurgy (M. Yu. Bal'shin, 1948, publ. *Metallurgizdat*) is said to contain a lot of new research results by its author and several collaborators, with suggestions for further study. Distribution of pressure and internal stresses residual elasticity, and density variations are discussed, and several advantages claimed for two-way pressing in the form here adopted.

Mond Nickel Fellowships

Applications Invited for 1952 Awards

THE Mond Nickel Fellowships Committee has invited applications for the award of Mond Nickel Fellowships for the year 1952. Awards will be made to selected applicants of British nationality educated to university degree or similar standard, though not necessarily qualified in metallurgy, who wish to undergo a programme of training in industrial establishments. They will normally take the form of travelling fellowships—awards for training at universities may be made in special circumstances. There are no age limits though awards will seldom be given to persons over 35 years of age. Each fellowship will occupy one full working year. The Committee hope to award up to five fellowships each year of an average value of £750 each.

Mond Nickel Fellowships will be awarded in furtherance of the following objects:

(a) To allow selected persons to pursue such training as will make them better capable of applying the results of research to the problems and processes of the British metallurgical and metal-using industries.

(b) To increase the number of persons who, if they are subsequently employed in executive and administrative positons in the British metallurgical and metal-using industries, will be competent to appreciate the technological significance of research and its results.

(c) To assist persons with qualifications in metallurgy to obtain additional training helpful in enabling them ultimately to assume executive and administrative positions in British metallurgical and metal-using industries.

(d) To provide training facilities whereby persons qualified in Sciences other than Metallurgy may be attracted into the metallurgical field and may help to alleviate the shortage of qualified metallurgists available to industry.

Applicants will be required to state the programme of training in respect of which they are applying for an award, as well as particulars of their education, qualifications and previous career. Full particulars and forms of application can be obtained from: The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1. Completed application forms must reach the Secretary by 1 June 1952.

New Standard Samples

TWO new standard samples are now available, it is announced by the Bureau of Analysed Samples, Ltd.

BCS No. 247, White Cast Iron (content: total carbon 3.07, sulphur 0.186 per cent), has been specially prepared for the determination of total carbon and sulphur by combustion. In the absence of graphite, 80 mesh crushed material presents no difficulty regarding the distribution of graphite, and is therefore specially recommended for daily routine checks put through a combustion furnace prior to carrying out determinations for total carbon or sulphur.

BCS No. 246, Nb-Mo. 18/8 Stainless Steel (content: carbon 0.062, niobium 0.82. molybdenum 2.89 per cent) has been specially prepared for checking the determination of niobium in stainless steels, also for giving accurate determinations of carbon in low-carbon stainless steels. It is also useful for checking the determination of molybdenum in high-molybdenum stainless steels.

Each standard sample is available in bottles of 25, 50 100 and 500 grams and can be obtained through the usual laboratory furnishers or direct from Bureau of Analysed Samples, Ltd., 234 Marton Road. Middlesbrough. Each bottle is provided with a certificate giving the results of each analyst and an outline of the method of analysis used for each element.

Canadian Nickel Record

THE International Nickel Company of Canada mined more ore from underground in 1951 than in any year in its history, Dr. J. F. Thompson, chairman and president, disclosed recently. Production of ore from underground was 7,780,000 tons, an increase of 2,000,000 tons over that of the previous year. Total ore mined from both underground and surface operations was 11,800,000 tons, compared with 9,849,000 tons in 1950.

The company operated at maximum capacity in 1951. Emergency facilities were installed and put into operation several months ahead of schedule. Sales of nickel, nickel alloys, copper, platinum and other products in 1951 are estimated at $286,700,000 (in terms of U.S. currency) compared with $228,071,346 in 1950.

Metal-Finishing by Vacuum Evaporation

A Commercial Method for Finishing Jewellery

THE manufacture of costume jewellery involves the application of a brilliant and sparkling finish to a large quantity of very small objects, which depend primarily on polish and lustre for their attraction. The jewellery may be produced by various methods such as stamping or—more commonly—casting in low-melting metals. A process widely advocated by the Design and Research Centre for the Gold, Silver and Jewellery Industries enables low-melting alloys to be centrifugally cast into rubber moulds by machines of commercial size. Whatever the method adopted, there remains the problem of producing the desired lustre and sparkle. The conventional metal polishing or electro-plating processes are expensive, especially in labour, and are often uneconomic. Moreover, the shortage of copper and zinc has led to the use of alternative materials such as tin castings and plastics, which are less easily finished by the traditional methods.

These difficulties have been overcome by a process demonstrated and publicised by the Design and Research Centre, which involves three main operations. In the first operation a lacquer is applied to the metal or plastic wares; it fills the pores and by surface tension draws up to a smooth and shiny surface, even when the original surface is dull or rough. The goods are then metal-finished in a suitable manner and the finish inherits the smoothness of the lacquer. Finally, it is usual to apply a second coat of lacquer in order to protect the metal.

Vacuum Evaporation Chosen

Various methods of metal-finishing were considered by the Design and Research Centre, the process finally selected for development being known as vacuum evaporation. This process is carried out in a high vacuum of 10^{-4}—10^{-5} mm., the metal being boiled or vaporised by means of an electric filament, which is usually a tungsten wire on which the pieces of metal are hung like hairpins. The metallic vapour radiates through the surrounding space until the flying atoms of metal meet a cool surface and condense to a solid film. Since the metallic vapour proceeds in a straight line from the heated metal to the objects being coated, it is necessary that the articles should be caused to revolve slowly in order that all surfaces may be covered. The Design and Research Centre have suggested a rotating jig for this purpose, which is quite simple to make.

Since the coating is deposited atom by atom it can be built up to any desired thickness, but it is usual to continue the process until an opaque film of the order of 4 to 5 microns has been formed. Such a very thin coat being easily damaged, it is generally protected by a second coat of transparent lacquer, which is also very thin.

Coating's Structure

The structure of the metal coating is not very crystalline. For costume jewellery it is quite immaterial whether the article to be coated conducts electricity or not, so that metallic and non-metallic surfaces can be treated with equal ease. In the case of applications in which high resistivity and dielectric properties are important, electrical conductivity must, of course, be taken into consideration.

Vacuum-operated films have been known for many years, but it is only recently that progress in the design and production of apparatus has allowed them to be commercially produced. Self-contained and largely automatic plants for vacuum evaporation are now obtainable from several manufacturers. Each installation consists essentially of three main parts. There is, first of all, an air-tight vessel which contains the filament. The articles to be coated are arranged as closely as possible round the walls of the vessel and may be mounted on rotating jigs. The second section of the apparatus comprises the pumping equipment, which must be capable of reducing the pressure in the airtight vessel to a very low value in a reasonably short time. It consists of a mechanical pump for the major reduction of pressure and a diffusion pump for producing the high vacuum. The fluid employed at the Centre is a silicon oil. Finally, there is the electrical equipment, which provides the heat required for vaporisation and also generates an ionic discharge to clean up the pieces before they are coated.

The general cycle of operations is as follows: The pumping plant is started up and left running continuously while the apparatus is in use, the container being shut off from the pumps by a valve when it has to be opened to the air. The pieces to be treated, which have previously been lacquered or stoved, are mounted on suitable racks or jigs. The jigs are put into the chamber and a new filament is put between the clamps with a small piece of the coating metal on it.

Operation of the Jigs

The container is then closed and the valve is opened to evacuate it. After a short interval, the high-tension electrical discharge is switched on for five minutes to 'clean up' the articles from residual absorbed gas. Pumping is continued until the current through the discharge circuit falls to nothing. The filament-heating current is then switched on and increased to the proper value. The jigs are slowly turned, the valve between the container and the pumps is closed, and air is admitted to the container, which is opened and unloaded. The whole cycle takes 15 minutes, most of this time being taken up with exhausting the chamber. The actual time of evaporation is about half a minute. The metals to be evaporated are renewed each cycle, but the consumption of metal is small. The tungsten filaments require to be renewed from time to time.

Most metals can be vaporised, but the lower-melting metals are, of course, the easiest to handle. Alloy coatings cannot as yet be produced by this method, since the individual metals distil off at different speeds. Some promising experiments have been carried out and research on this subject is still proceeding. Silver is easily evaporated, but the film obtained is subject to tarnish in the same way as electroplated silver. Chromium and nickel are difficult to vaporise.

For producing a brilliant white finish aluminium has been found very suitable. On account of its low melting point it can be evaporated at a convenient temperature and it produces a white film with considerable resistance to tarnish. Finally, it has the advantage of being easily obtained and relatively cheap.

There is a considerable demand for coloured finishes. These can be obtained from copper and gold, both of which can easily be evaporated. A copper coating is readily tarnished, however, while gold yields a film which is not the rich lemon yellow desired but a much darker colour resembling 'old gold' in appearance. It is preferable therefore to produce coloured finishes by evaporating a white metal such as aluminium and providing the colour by means of a coloured lacquer. This may be achieved by using a coloured lacquer but this method is not recommended since it is impossible to obtain a uniformly tinted finish. More satisfactory results are obtained by means of colourless lacquers which are dyed with a spirit stain on a strict time schedule. In this way uniform and repeatable tints can be produced.

The success of the vacuum evaporation process depends primarily on the treatment and application of the lacquers, which are of critical importance. Many plastic articles contain sufficient volatile material to make it imperative to seal the surface by lacquering. The lacquer selected must be capable of drying, with or without stoving, to a condition in which no further vapour is evolved during vacuum treatment. On plastic articles the stoving temperature may be limited to about 60°C. because of the danger of decomposition of the material at higher temperatures. The volatiles are therefore removed either in a convection oven or by infra-red rays. A final consideration is that the first coat of lacquer must not be softened or attacked through the pores of the metal by the second coat.

Precautions in Applying

The method of applying the lacquer is also important. Special precautions must be taken to avoid either the formation of drops and thick edges or the filling in of stone holes and crevices. To ensure uniformity of coating when a dipping process is employed, a machine has been developed for lowering the vessel containing the lacquer very slowly away from the articles. Either hand or automatic spraying may also be employed, one of the principal difficulties being that it is necessary to use rather a thin lacquer, so that a very high percentage of the material applied is evaporated off. The difficulties of applying the lacquers have hitherto been the chief obstacles hindering the development of the vacuum evaporation process for costume jewellery, but considerable information on

this subject has now been obtained by the Design and Research Centre. As a result of the development work undertaken by the Centre a number of firms in the costume jewellery industry have purchased plant for the vacuum evaporation process.

In other industries similar methods are being adopted for various purposes. In the motor car accessory trade, for example, head lamps are lacquered, stoved, and metallised to give the highly reflective surface required. Transparent plastic pressings are vacuum evaporated from the back, so that viewed from the front they have a metallic appearance, and if the coating is not too thick they look like polished metal. Another important field of applications is lens blooming, in which a coating of magnesium fluoride is evaporated on a lens surface to the critical thickness of a quarter of the wave length of average light, thereby increasing the transmission of the light rays falling on the lens. The process is also used for such applications as the production of electrical condenser foils, which are made of a dielectric material coated with metal on one side. Plastic haberdashery is metallised and treated in the same way as plastic jewellery.

It is possible that continued development and research will extend the scope for vacuum evaporation by enabling it to be carried out through a stencil, so that the metallic coat can be deposited in the form of a pattern.

To Discuss Corrosion

BELGIAN and British scientists will discuss problems of corrosion together at a meeting to be held in London next month. The occasion will be a joint meeting of the Corrosion Group (SCI) with the Section on Protection from Corrosion of the Association Belge pour L'Etude, L'Essai et L'Emploi des Materiaux (ABEM), when papers will be presented and discussed on 'Protective Coatings (Metallic and Paint) under Conditions of Atmospheric Corrosion'.

The discussion will be held in two sessions, from 10 a.m. to 1 p.m. and 2.30 p.m. to 4.30 p.m., on Friday, 14 March, at the Iron and Steel Institute, 4 Grosvenor Gardens S.W.1.

Belgian and British contributions to the programme will include 'The Work of Protective Coatings Commission of the ABEM and its Principal Results', by Professor P. Erculisse, president ABEM, and 'Research Work on the Protection of Steel against Corrosion', by F. Fancutt and Dr. J. C. Hudson (Protective Coatings sub-committee BISRA).

In connection with the meeting a dinner is being arranged at the Mayfair Hotel, Berkeley Street, London, W.1, at 7.30 for 8 p.m., at which members of the council of the SCI and the Belgian visitors will be present. Members and their friends who wish to attend should notify the assistant secretary, SCI, not later than Monday, 3 March.

Australian Petroleum Coke

PETROLEUM coke, an essential ingredient of the electrodes used in the aluminium reduction process, has in recent years been obtainable from only one source in Australia, for the needs of the Australian Aluminium Production Commission. This has been from the Glen Davis Shale Oil Refinery plant in New South Wales. With the closing of the Glen Davis works the refinery is now being moved to Bell Bay, Tasmania, which is the centre of the Commission's activities. The Commission anticipates that not only will supplies of this essential material be ensured, but the co-ordination of oil refining operations with those of the aluminium plant will result in a capital saving of £A200,000.

In accordance with the instructions of the Australian Government, the Commission has developed its construction programme with the object of bringing the aluminium plant to the production stage late in 1953.

Titanium Pigment Prices

Prices for 'Kronos' Brand Titanium Pigments have been increased as from 1 March, 1952. The new prices for quantities of less than 5 tons are as follows: Rutiox 'CR' Grade, £143 per ton; Anatase 'E' Grade, Anatase 'HR' Grade, Anatase Granular Grade, £125 per ton; Titanium White 70 per cent Grade, £97 per ton; Extra 'T' Grade (50 per cent), £78 10s. per ton; Standard 'T' Grade (25 per cent), £55 5s. per ton.

World Mineral Statistics

Figures for Period 1944-1950 Published

PRODUCTION, imports and exports of the mineral industry for the seven years 1944-1950 are collated in a 'Statistical Summary of the Mineral Industry,' now available (HMSO 25s. net).

This publication continues under a slightly different title the well-known series of statistical summaries formerly published for the Imperial Institute under the title of 'The Mineral Industry of the British Empire and Foreign Countries.' It is now prepared by the Statistical Section of the Mineral Resources Division of Colonial Geological Surveys.

Estimates Included

Although the statistics given attempt to cover the world, it has not been possible to give complete information for some countries, especially those of eastern Europe, but in order that world totals may be arrived at, estimates for such countries have been included.

Many interesting facts are revealed by the summary. Production of sulphur for instance, at present one of the world's most serious shortages, was 5,192,184 long tons in the U.S.A. in 1950 compared with 3,218,158 long tons in 1944. During the period under review imports of sulphur to the United Kingdom rose from 197,231 long tons to 438,551 long tons.

Total world production of copper ore in 1950 was 2,455,000 long tons in terms of metal compared with 2,500,000 tons in 1944. Canada produced 234,701 tons, the U.S.S.R. an estimated 220,000 tons and the Belgian Congo 173,142.

The metallic production of zinc was 2,010,000 tons compared with 1,615,000 tons in 1944. Of this the U.S.A. supplied 753,096 tons, Russia an estimated 210,000 tons and Canada 182,543. The U.K. imported 196,422 tons of ore and concentrates and 141,914 tons of ingots, bars, etc., and Belgium-Luxemburg imported 397,316 tons of ore. The U.S.A. imported 221,440 tons of ore and 138,665 tons of spelter.

The 1950 production of lead metal amounted to 368,000 long tons compared with 287,000 tons in 1944 and 331,500 tons in 1949. The United States was responsible for 450,937 tons, Russia 240,000, Mexico 217,362, and Australia 198,593 tons.

Analysis of Aluminium

TWO further parts of its programme for methods of analysis for aluminium and aluminium alloys have now been published by the British Standards Institution. Part 1, 'Copper', was published in March, 1951.

Although in some cases the methods appear to be lengthy, it should be realised that they are recommended primarily for 'referee' purposes. During their preparation, check analyses have been carried out by a number of independent analysts and the reproducibility to be expected is given over the range for which the methods are recommended.

The new standard, B.S.1728:1952 deals with magnesium (mercury cathode method), part 2, and zinc (mercury potassium thiocyanate method), part 3. Reagents required, recommended methods of sampling and test precedures are specified.

In Part 2, 'Magnesium', the method provides (a) for alloys having a silicon content less than 2 per cent, and (b) for alloys having a silicon content greater than 2 per cent. This method is applicable to alloys having magnesium contents between 0.02 and 15 per cent.

With part 3, 'Zinc', the method is applicable to alloys having zinc contents between 0.2 and 6 per cent.

An alternative method for the determination of zinc, using a polarographic technique, is in course of preparation and will be issued shortly.

Copies of these standards may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1. (2s. each, post paid).

Zinc-Rich Paints Defined

THE Corrosion Committee of the British Iron and Steel Research Association has issued the following statement about zinc-rich paints:

'The use of the term 'zinc-rich paint' should be restricted to paints containing a sufficiently high percentage of zinc pigment to ensure direct electronic contact between the metallic particles in the dry paint film. There are theoretical reasons for believing that in the simplest case this will not occur unless the metallic zinc constitutes 92/95 per cent by weight of the dried paint film—the exact value depending on the specific gravity and other properties of the vehicle.'

The Chemist's Bookshelf

ENCYCLOPÆDIA OF CHEMICAL REACTIONS. Vol. IV. Compiled and edited by C. A. Jacobson. New York: Reinhold Publishing Corporation. London: Chapman and Hall. Pp. ix + 790. 112s.

Previous volumes of this work have been reviewed in this Journal (THE CHEMICAL AGE, **55**, 575; **60**, 165; **62**, 343) and this volume continues to present in a similar way a compilation of the published reactions of the elements and their compounds, being concerned with the following (the numbers denoting the separate entries for each element): iron, 566, lanthanum, 128; lead, 488; lithium, 447; magnesium, 256; manganese, 306; mercury, 495; molybdenum, 171; neodymium, 122. These nine elements bring to a total of 45 the number of elements dealt with in the first four volumes.

Following up a comment which he made in reviewing Vol. II, the reviewer noted the following points in rapid succession: on p. 566 two reactions of mercuric thiocyanate appear under $Hg(CNS)_2$; on pp. 628-632, fifteen reactions are listed under $Hg(SCN)_2$: one result of this is that there is no correlation between the parallel behaviours of $Hg(CNS)_2$ with KCNS (IV-2338) and with NH_4CNS (IV-2607) and NaCNS (IV-2608); in the latter series of reactions solutions of mercuric thiocyanate are referred to on several occasions as being used in the reactions—but as normally carried out these reactions use solutions of the potassium or ammonium double salt, mercuric thiocyanate itself being practically insoluble in water; there is no cross reference to the reactions quoted, e.g., in Vol. II, between cadmium salts and potassium and ammonium mercuric thiocyanate and selenocyanate; on p. 565 the compound $Hg(CNO)_2$ is referred to once as mercury fulminate, twice as mercuric fulminate and twice as mercuric cyanate; in one of these reactions, that between $Hg(CNO)_2$ and thiosulphate solution, an equation for the reaction between sodium thiocyanate and mercuric sulphate which seems to have no bearing is included, in addition to the correct equation for the reaction; on p. 564, reaction IV-2330 gives the formula of mercuric oxycyanide as $Hg(CN)_2.HgO$ and reaction IV-2331 gives it as $(HgCN)_2O$; these reactions, although listed in the formula index, cannot be found in the name index; but (reaction IV-2610 deals with the action of thionyl chloride on $Hg(CNS)_2$) there is an entry in the name index for the reaction of thionyl chloride with $SOCl_2$!

While not attempting to minimise the heavy task facing the contributors and editor of this work, one feels that a chance reference should not have led directly or indirectly to such an extensive series of inconsistencies and flaws.

In the introduction it is stated that a number of duplicates were encountered in compiling the list of reactions, and that the majority of such reactions were removed completely and other reactions substituted where possible. Even presuming that it is intended to imply that it is only the duplicates which were removed and not the reactions, it is still not clear how it was possible to substitute other reactions since this is presumed to be a comprehensive compilation and therefore the 'other reactions' should be included in their appropriate place.

Comprehensive formula indexes of the reagents and products occupy some 52 pages. There is a brief three-page name index for reagents which, as already suggested above, is not comprehensive. Indeed, it is so limited that the reason for its inclusion and the principle on which its entries have been chosen are impossible to determine. It includes such names as 4-amino-2-toluene sulphonic acid, ammonium molybdate, barium thioglycolate (thioglycollate in the text), Debray's chloride, Epsom salt, haematite, potassium thiocyanate, rubidium bromide, talc, thiourea, yttrium chloride and

zirconia—a list which does not seem capable of classification under any rational heading.

The reviewer would close by emphasising that he has chosen here to devote considerable space to pointing out flaws in the work primarily because in earlier reviews the excellence of the idea behind this book and the general presentation of it have been clearly stated, and those familiar with the book will be well aware of the general usefulness of the work.—C.L.W.

PIPE RESISTANCE for hydraulic, lubricating and fuel oils and other non-aqueous fluids. By T. E. Beacham. London. E. & F. N. Spon, Ltd. 1951. Pp. 61. 30 Figures. 18s.

The object of this book, as stated in the preface, is 'to provide a simple and accurate means of estimating pipe resistance for flow of oils, spirits and other non-aqueous liquids'. This is accomplished by 20 'Pipe-resistance Diagrams' from which the pipe resistance (lb. sq. in. per foot) can be read, given the flow (Imp. Gal. per min.), the bore of pipe (inches) for oils of known viscosity, and specific gravity. Part I of the book deals with practical considerations and the use of the diagrams. A table is given of conversions from centistokes to Redwood No. 1 (the measurement used in the resistance diagrams) and Saybolt Universal, and a chart showing the variation of viscosity with temperature for a series of industrially important fluids is included. Part II consists of the pipe resistance diagrams for oils varying in viscosity from 10,000 Redwood to 30 Redwood, for drawn tube, steel and W.I. pipe and for galvanised pipe. A little practice is necessary after which the solution of most types of resistance calculations can be accomplished with very little effort and surprising accuracy. An appendix includes a brief account of the basis upon which the diagrams are derived with details of the relative roughness factors, etc. The book should prove of considerable value to design engineers. It is clearly printed and attractively set out.—F.M.

Aluminium Razor Edges

A Gillette Industries, Ltd. patent employs a method for the deposition of vaporised aluminium on the edge of steel razor blades. The aluminium forms crystals on the blade edge of Al_2O_3 which, it is claimed, give a harder edge than the best steel blades.

'Films Can Help Industry'

Scientific Film Associations' Conference

CO-OPERATION between films and industry will be the subject of a special conference to be held next month at St. Leonards-on-Sea, Sussex. Organised by the Scientific Film Association, the conference entitled 'Films Can Help Industry,' will begin on Friday evening 4 April and finish on Sunday afternoon, 6 April.

The opening talk on Friday will be given by a Ministry of Labour representative, with a reply by Frank Hoare, chairman of the Association of Specialised Film Producers, Sir Kenneth Goadby, president of the Scientific Film Association will be in the chair. This will be followed by the first film display 'Training Within Industry.'

'What Films Can Do for Industry and What Does Industry Require of Films?' will be discussed at the first session on Saturday morning. Principal speakers will be Edgar Anstey (British Transport Commission) and E. N. Marriott (Stewarts and Lloyds, Ltd.). The next period will be devoted to discussion.

Arranged in Groups

To facilitate exchange of views six groups have been arranged under a leader, and each allotted a particular subject, but these, of course, may be supplemented by any others which the delegates wish to propose.

In the afternoon, C. B. Fergusson (manager, Heavy Construction Department, G. A. Harvey and Co., Ltd.), will preside at a film display 'Works Information within Industry.' Saturday will be concluded with a report from the discussion groups and a review of new film techniques by Derek Stewart (SIMPL) with Basil Wright (producer, film critic and broadcaster) in the chair.

A talk on 'Ethics in the Production of Documentary Films,' will be given by Sir Arthur Elton on Sunday morning with R. Davies (chairman, Industrial Committee Scientific Film Association) as chairman.

The programme will end with a film display 'Industrial Films for Public Information' when C. H. Dand (chief distribution officer, Central Office of Information) will preside.

Full particulars can be obtained from the Scientific Film Association, 164 Shaftesbury Avenue, London, W.C.2.

HOME

Sales Office Moved

Bakelite, Ltd., have announced that their northern sales office has now moved to more spacious quarters at the Royal Exchange, Manchester, 2. Telephone No.: Blackfriars 5174-7.

Overseas Trade

With a record year behind it the chemical industry has got off to a flying start in 1952, the total value of exports for chemicals, drugs, dyes and colours being £13,967,461 in January, compared with £11,279,654 in the previous month and £10,437,464 in January, 1951 and only £7,945,572 in January, 1950. Value of trade with Australia and India was nearly double that of January last year, while exports to the U.S.A. at £1,203,844 were nearly three times greater.

Technical College Jubilee

A service of thanksgiving to commemorate the jubilee of the Sir John Cass College, Jewry Street, E.C., was held at St. Botolph, Aldgate, on Wednesday, 20 February. The service was attended by the Lord Mayor of London, Sir Leslie Boyce, accompanied by the Sheriffs, who afterwards went on to a reception at the college. The Sir John Cass Technical Institute, as it was known until 1950, was formally opened in 1902, based on a school founded in 1710.

Change in Research Tempo

Newer and swifter methods of handling information have become necessary now that a speed-up and world coverage of communications has led to a change in the tempo of research. This was emphasised by Miss E. M. R. Ditmas in her address at the opening of a five-day course organised by the Association of Special Libraries and Information Bureaux on the selection, compilation and dissemination of specialist knowledge, which began in London on 21 February.

Suggestions Sought

The Committee of the Plastics and Polymer Group (SCI) are now drawing up plans for the meetings to be held in the 1952-53 session. Members having any material in the form of a paper or review lecture which they would like to present to the Group have been asked to contact the hon. recorder, Mr. A. R. Burgess, soon.

KID Exemptions

A number of additional chemicals are included in an Order under Section 10(5) of the Finance Act, 1926, made by the Treasury, which continues from 20 February until 18 August, 1952, the exemption of all the articles from Key Industry Duty included under previous Orders which expired on 19 February, with the deletion of certain items. Full particulars are set out in the Safeguarding of Industries [Exemption (No. 2)] Order, 1952, published as Statutory Instruments, 1952, No. 277 (HMSO, 5½d., post paid).

Shipping of Dangerous Goods

The report of Departmental Committee on the Carriage of Dangerous Goods and Explosives in Ships was published on 18 February. The committee, under the chairmanship of Dr. H. E. Watts, H.M. Chief Inspector of Explosives was drawn from members of the chemical and shipping industries and Government Departments concerned. The report (HMSO, 15s. 7d., post paid) sets out recommendations for the packing, stowage and labelling of over 600 substances, and for the carriage of explosives.

Import of Acetone

The Additional Import Duties (No. 1) Order, 1952, has been made by the Treasury continuing the exemption of acetone from additional duty (under the Import Duties Act, 1932) from 20 February to 18 August, 1952. The Order is published as Statutory Instruments, 1952, No. 276 (HMSO, price 3½d., post paid).

Anti-corrosion Precautions

Satisfactory results are reported on the system of cathodic protection against corrosion in the new pipe-line linking the tanker terminal at Finnart, Loch Long, with the Grangemouth refinery. Since April last year crude oil has been pumped through the line. The protection is applied by the installation of magnesium anodes at 340 points along the 60-mile distance. An extra feature has been the use of radioactive cobalt isotopes carried by the pipe-line scrapers which are pumped through to remove deposits.

OVERSEAS

Specific Reagent for Thorium

An analytical reagent which is said to be specific for thorium has been developed by Fine Organics Inc., of America. It is 1 - (*o* - arseno-phenyl-azo)-2-naphthol - 3,6 - disulphonic acid, and has been under test, with other reagents, at the U.S. Geological Survey Laboratories in Washington. These laboratories are trying to develop a more rapid method for determining thorium and other radioactive metals in ores.

Photographs on Aluminium

A new process for making photographic reproductions on aluminium is claimed by M. Schenk of Switzerland. The process, known under the trade name of 'Aluphot' uses à photosensitive anodised aluminium plate and produces prints which are resistant to light, abrasion, water, atmosphere, heat and organic solvents, it is claimed.

Ozone as a Fungicide

Experiments on the use of ozone for preventing stored Brazil nuts from going mouldy may have applications in the storage of corn, rice and beans. Brazil nuts, being gathered under very damp conditions, tend to go mouldy very easily, and as a large percentage of imports have to be written off, the price of the good nuts suffers accordingly. Prices are also increased by the extensive drying necessary to preserve the nuts. Ozone incorporated in the ventilating system appears to combat mould, and a Brazilian company—Industrias Electroaire do Brasil—is starting operations shortly.

Additional Carbide Plant

A $7,000,000 plant to produce carbide will be built at Varennes, Quebec, by Shawinigan Chemicals, Limited. The plant, to be built on a 200-acre site beside the St. Lawrence deep-sea-ship channel, will have a capacity of about 100,000 tons of carbide annually. This will be additional to the company's present capacity at the great carbide plant at Shawinigan Falls, largest in the Commonwealth. Construction of the new plant will be carried out by The Shawinigan Engineering Co., which, like Shawinigan Chemicals is a wholly owned subsidiary of The Shawinigan Water & Power Co.

Australian Uranium Deposits

The possibility of large undiscovered deposits of uranium in the Northern Territory of Australia was revealed by Dr. C. Davidson, chief geologist of the British Atomic Energy Organisation, in Darwin on 24 February. He had visited the Rum Jungle uranium mine and considered the propects very favourable. Dr. Davidson will also inspect the Radium Hill uranium field in South Australia.

Not Economic

Because its production is said not to be an economic proposition, the manufacture of chloride of lime in South Africa will probably be discontinued in June, it is reported. The main users, laundries and some branches of the textile industry will be able to carry on with supplies from Britain, although these have been limited by the shortage of steel drums.

Record Sales Total

It is reported from St. Louis that Monsanto Chemical Company sales reached a record total of $272,845,034 for 1951—20 per cent more than the previous record of 1950. That total does not include net sales of $34,538,308 recorded by Monsanto's British and Australian companies. In its fiftieth annual report to stockholders, Monsanto listed an income, before taxes, of $62,120,884 by the American company.

T.B. Drug Claimed

A Swiss chemical company claimed in Basle on 22 February that it had found a new drug, 'Rimison', which was a cheaper and more effective drug against tuberculosis than any known drug. No details were given.

Proteins from Whales

Waste water residue which remains after whales have been processed for their oil, may soon be put to use in South Africa, according to a statement issued in Johannesburg by the Council for Scientific and Industrial Research. Scientists of the National Chemical Research Laboratory have established that the waste water may be spray-dried into a powder claimed to be rich in proteins and containing B-group vitamins.

Works' Safety Conference

To be held at Buxton, 2–4 May

THE Association of British Chemical Manufacturers is holding a Chemical Works' Safety Conference at the Palace Hotel, Buxton, Derbyshire, from 2-4 May. A Brains Trust will be included and papers are to be read on the following subjects:

'Safety in the Laboratory and in the Plant' by L. J. Burrage, Ph.D., D.Sc., A.M.I.Chem.E., F.Inst.F., F.R.I.C., General Chemicals Division, Imperial Chemical Industries, Ltd.

'Toxic Dusts in Industry' by J. S. Evans, M.A., B.Sc., Federation of British Industries.

'The Relation between Plant Strength and Dust Explosion Relief' by D. Matheson, M.A., Ph.D., B.Sc., Factory Department, Ministry of Labour and National Service.

'Safety in Plant Maintenance' by C. A. Beaton, M.B.E., Monsanto Chemicals, Ltd.

'The Safe Transportation and Storage of Chemicals' by the Works' Safety Committee of the Association of British Chemical Manufacturers.

The chairman of the conference will be Mr. J. Davidson Pratt, C.B.E., M.A., B.Sc., M.I.Chem.E., F.R.I.C., ABCM Director.

The fee per delegate is £8 8s.; this includes full board and accommodation from and including dinner on Friday evening, up to and including lunch on Sunday, after meal and mid-morning coffee and gratuities, also free preprints of the papers and one copy of the subsequent published Proceedings.

Forms of application and detailed programme, together with information regarding travel between London and Buxton, can be obtained from the Association of British Chemical Manufacturers (Intelligence Officer), 166 Piccadilly, London, W.1.

Chemicals in Yugoslavia's

Post-war Re-establishment

NATURAL wealth in raw materials and sources of energy has played an important part in re-establishing and developing Yugoslavia's chemical industry which was largely destroyed during the war. Another asset has been the country's considerable mineral wealth, which includes deposits of brown coal, iron, copper, lead, zinc, manganese, chromium, antimony, nickel, silver, mercury, naphtha, bismuth, cadmium, molybdenum, arsenic and wolfram.

Electrochemical and electrometallurgical industries have been greatly aided by the availability of water power for generating electric energy.

A wide range of chemical products has been manufactured and these are now available for the benefit of industry and medicine in Yugoslavia where they were not previously obtainable.

Satisfactory progress has also been made in the pharmaceutical industry which, according to *Commercial Information* (No. 12, 1951), issued by the Yugoslav Chamber of Commerce, is now supplying 90 per cent of the country's requirements compared with 10 per cent before the war. Ten new synthetic products are expected to be produced this year, while the general quality of many items has been improved, bringing the standard up to that expected by foreign consumers.

Glass manufacture for chemical, pharmaceutical, optical and industrial purposes is also expanding rapidly. Production by the glass industry is said to be about 300 per cent greater than the pre-war level, and more new plants are expected to come into operation this year.

A prosperous chemical industry, it is realised, is essential to the well-being of Yugoslavia, for on its expansion depends the development of many other industries.

Chemical products now available for export include the following: Ferrochrome, ferrosilicon, carbide, copper sulphate, calcium cyanamide, caustic soda, potassium-metabisulphite, lithopone, magnesium and sodium sulphates, red lead, hydrochloric and sulphuric acids, sodium bicarbonate, acetone, amyl and butyl acetate, formaldehyde, acetic acid, methyl alcohol, lead acetate, etc.

Addendum

In our issue of 23 February we published a report concerning a new standard for British automatic pipettes (see page 304) but unfortunately the number of this standard was omitted. It is B.S. 1132:1952 and copies can be obtained from the British Standards Institution, Sales Department, 24 Victoria Street, London, S.W.1. Price 2s. post free. In the first line of this report, a reference was made to B.S. 1583—'One-Mark Bulge Pipettes.' It should, of course, have been 'bulb', not 'bulge'.

Publications & Announcements

ALCOHOLS of medium chain length are required for a number of important industrial applications. To meet this need 'Alphanol' 79 and Nonanol are now being produced in the United Kingdom, from locally available raw materials, by the carbonylation reaction, which is also known as the Oxo process. Various applications of 'Alphanol' 79 and Nonanol, particularly their use for the manufacture of plasticisers, together with their description and physical and chemical properties, are set out in a booklet now available from Shell Chemicals, Ltd. (Distributors), London.

* * *

POSSIBILITY of economic recovery of vanadium from western phosphate rock through a combination of two distinct processes was disclosed recently when the U.S. Bureau of Mines released the results of extensive tests conducted in Oregon and Idaho to extract the scarce metal. The report contains technical descriptions of the smelting, oxidising, and leaching tests, and offers statistical data of the various results obtained. A combination of beneficiating, smelting and roast-leach processes may make it economically feasible to recover not only vanadium but also phosphorus. A free copy of Report of Investigations 4822, 'Processes for Recovering Vanadium from Western Phosphates', may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

* * *

THE testing and calibration of thermocouples demands a highly accurate and stable source of low level power. From the viewpoint of accuracy and stability, the obvious basis for such a source is a standard cell, but for testing and calibration purposes a means must be found of obtaining appreciable power for any length of time. This problem is claimed to have been solved by Standard Telephones and Cables, Ltd., in their 74131-A D.C. Milliwatt Calibrator, which uses a Muirhead Miniature Weston Standard Cell Type D-550-A as the reference voltage in a circuit which places no load upon it. The Standard cell e.m.f. is applied between one of the grids of a double-triode valve and earth and a voltage derived from a potentiometer network supplied with stabilised D.C. is applied to the other grid. By adjustment of the potentiometer resistance, this voltage can be made equal to the standard cell voltage, and then used as a reference voltage, against which the standard output of 1 mW into either 600 or 75 ohms can be checked. The Muirhead cell was chosen, say the company, because it combines a high degree of accuracy and stability with robust mechanical construction and because it is cheap to replace should this be necessary.

* * *

RADIOACTIVE techniques and their possible industrial application are becoming better known, partly due to the Federation of British Industries Industrial Research Committee which in May last year (THE CHEMICAL AGE, **64**, 735), in collaboration with the Atomic Energy Research Establishment, organised a second conference on 'The Use of Radioactive Isotopes in Industry'. The nine papers reads at the conference which was held under the chairmanship of Sir Wallace Akers, C.B.E., have now been issued as a booklet (2s. 6d.) by the FBI. The main emphasis of the papers is on the application of radioactive isotopes to production processes.

* * *

SAVING in space and size of plant achieved in treatment of polluted waters by means of the 'Ionomatic' process is described by the Pulsometer Engineering Co., Ltd., Reading, in its latest pamphlet. The illustration on the front page shows a Pulsometer plant with only two treatment tanks needed using the 'Ionomatic' method, while the four additional tanks that it is claimed would be required for conventional methods are drawn in by chain-dotted lines. The process employs the most recently developed scientific principles of ionisation for accelerating the rate of precipitation of solid, colloidal, and other matter in suspension in the water treated. Rate of precipitation of the ionised particles is so high that the major proportion of the foreign matter is removed rapidly from the water before filtration. A typical flow diagram is given for Pulsometer 'Ionomatic' sodium silicate treatment for the removal of solids from polluted water.

Next Week's Events

MONDAY, 3 MARCH

Royal Institute of Chemistry

London: Woolwich Polytechnic, S.E.18, 6.45 p.m. (with Woolwich Polytechnic Scientific Society), film and lecture. D. Mahon: 'The Nature of Plastics.'

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. A. Dinsdale: 'Recent Progress in Ceramics.'

Pharmaceutical Society

London: 17 Bloomsbury Square, W.C.1, 7.30 p.m. Brian Stanford: 'The Use of Films in Science Teaching.'

TUESDAY, 4 MARCH

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 5.30 p.m. Crop Protection Panel of the Agricultural Group. Dr. F. P. Coyne 'Insecticides in Public Health; Repercussions on Tropical Food Production.'

The Chemical Society

Leeds: University, 6.30 p.m. (with Leeds University Union Chemical Society). Lecture by Professor R. G. W. Norrish.

Chadwick Public Lectures

London: 17 Horseferry Road, Westminster, S.W.1, 5.30 p.m. Lieut.-Col. E. F. W. Mackenzie (director of water examination, Metropolitan Water Board): 'The Prevention of Dental Caries by the Administration of Fluorine in Public Water Supplies.'

Institute of Metal Finishing

Birmingham: James Watt Memorial Institute, Great Charles Street. Professor A. J. Murphy: 'Economic Aspects of Metal in Industry.'

Institute of Metals

Swansea: University College, Singleton Park, 6.30 p.m. R. T. Staples: 'The Direct-Reading Spectrograph.'

Textile Institute

Morley Town Hall, 7.15 p.m. Yorkshire Section with Morley Textile Society. C. V. Ward (managing director, Atmospheric Control, Ltd.): 'Pneumatic Transportation, Dust and Fibre Separation and Filtration.'

Incorporated Plant Engineers

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 6.30 p.m. Annual general meeting, followed by film display.

Bristol: Royal Fort, Bristol University. Western Branch. Oliver Lyle: 'Is Cost Always the True Measure of Economy?'

WEDNESDAY, 5 MARCH

Royal Institute of Chemistry

London: West Ham Municipal College, Romford Road, E.15, 6.30 p.m. Dr. A. C. Monkhouse: 'Smoke.'

Textile Institute

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 6.15 p.m. Annual meeting, London Section, followed by open discussion.

Institute of Welding

Manchester: Reynolds Hall, College of Technology, 7 p.m. J. R. Thomas: 'Automatic Arc Welding.'

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. Dr. A. J. W. Moore (Cambridge University): 'The Surface Structure and Friction of Metals.'

THURSDAY, 6 MARCH

The Chemical Society

Leicester: University College (with Leicester University Chemical Society). Lecture by Dr. F. L. Rose.

Liverpool: University, 4.30 p.m. Joint meeting with the RIC, SCI and BAC. Professor W. Wardlaw: 'Some Aspects of the Chemistry of Group IV Elements.'

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. 'The Rowett Research Institute' by D. P. Cuthbertson, director.

Institute of Metals

Birmingham: James Watt Memorial Institute, Great Charles Street, 7 p.m. W. F. Cartwright: 'The Steel Company of Wales.'

London: 4 Grosvenor Gardens, S.W.1, 7 p.m. Major P. L. Steed: Metallurgical Problems Arising from Stratospheric Flight.'

Leeds Metallurgical Society

Leeds: University, 7 p.m. D. C. G. Lees: 'Recent Research on Aluminium and its Alloys.'

Textile Institute

Manchester: 16 St. Mary's Parsonage, 6.30 p.m. (Joint meeting with the Society of Dyers & Colourists). A. Landolt (Ciba, Ltd., Basle): 'Modern Chemical Finishes on Cellulosic Materials.'

FRIDAY, 7 MARCH

Society of Chemical Industry

London: Institution of Electrical Engineers, Savoy Place, W.C.2. Two sessions.

10 a.m. and 2 p.m. The Plastics and Polymer Group. Symposium on: 'The Mechanical Properties of Plastics.'

Manchester: Engineers' Club, Albert Square, 6.30 p.m. Joint meeting with Manchester Section of the Food Group and the RIC. F. A. Paine: 'Materials for the Packaging and Conveyance of Foods'.

The Chemical Society

Dublin: Trinity College, 8 p.m. (with the Werner Society). Professor A. R. Todd: 'Recent Advances in Nucleotide Chemistry.'

St. Andrews: United College, 5.15 p.m. (with St. Andrews University Chemical Society). Professor Brynmor Jones: 'Some Aspects of Aromatic Substitution.'

Southampton: University College, 5 p.m. (with Southampton University College Chemical Society). Professor H. W. Melville: 'The Mechanism of the Breakdown of Macromolecules.'

Swansea: University College, 5.30 p.m. (with University College of Swansea Chemical Society). Sir Ian Heilbron: 'The Development of Organic Chemistry During the 20th Century.'

Society of Dyers & Colourists

Manchester: Midland Hotel, 7.30 p.m. The second George Douglas Lecture. Dr. Rowland Hill: 'Synthetic Fibres in Prospect and Retrospect.'

Society of Cosmetic Chemists of Great Britain

London: St. Bride's Institute, Bride Lane, E.C.4, 7 p.m. Dr. E. J. Moynahan (consulting dermatologist, Guy's Hospital): 'Cosmetics and Dermatitis.'

SATURDAY, 8 MARCH

Institution of Chemical Engineers

Birmingham: University, Edmund Street, 3 p.m. Midlands Branch. J. F. Short and P. Eaglesfield: 'Liquid/Liquid Extraction in Laboratory and Pilot Plant.'

Seaweed Symposium

AN international seaweed symposium, sponsored by the Institute of Seaweed Research, Inveresk, Midlothian, Scotland, is to be held in Edinburgh from 14 to 17 July 1952. Final arrangements have now been completed by the Organising Committee, which has the co-operation of corresponding delegates in the following countries: Australia, Canada, Chile, France, Germany, New Zealand, Norway, South Africa, Spain, Sweden and the United States.

Sessions will be held in the Department of Zoology, Edinburgh University, and will deal with phycology, algal chemistry, harvesting technology, utilisation in industry, medicine and agriculture and world seaweed resources.

Registration and accommodation forms may be had on application to Mr. T. W. Summers, Secretary to the Organising Committee, at the Institute.

Dutch Show Chemicals

A NUMBER of chemical items are included in a comprehensive Dutch Collective Exhibit at the Pakistan International Industries Fair which opens today and lasts until 6 April. The exhibit has been organised by the Netherland's Institute for the Promotion of Foreign Trade.

Amongst the chemicals listed are: ultramarine blue, phenol- and cresol-formaldehyde moulding powders, heavy chemicals, dyestuffs, fertilisers and pharmaceutical raw materials. The exhibitors are: AVIS Colour Works Ltd., Westzaan; Jean A. du Crocq, Jr., N.V., Blaricum; and van Perlstein and Roeper Bosch, N.V., Amsterdam.

Pakistan has in the past been almost exclusively a British preserve but in recent months Japan and other countries have been doing an increasing trade.

Chlorine Regeneration

THE Hercules Powder Company of America claim to be the first to install a commercial plant for the reclamation of chlorine from the hydrochloric acid produced in chlorination. Their acid comes from the chlorination of camphene to make toxaphene, and the basic process for chlorine regeneration is by reacting the acid with ferric oxide to give ferric chloride (the Fe_2O_3 contains some KCl to prevent the resultant $FeCl_3$ volatilising). The ferric chloride is then exposed to air, giving chlorine and regenerating the ferric oxide. A variation on this process is licensed from the Dow Chemical Corporation, which uses a moving bed instead of the two-stage process. Other methods for chlorine recovery from HCl have also been known, notably catalytic oxidation of the acid—a variant of the Deacon process.

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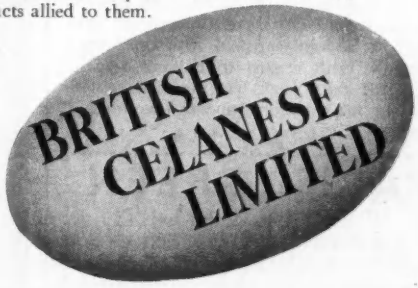

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Market Reports

LONDON.—Steady conditions prevail in most sections of the industrial chemicals market and prices generally are firm. Interest in textile chemicals remains quiet and the fine chemical market is reported to be slow. Contract deliveries of the leading soda and potash chemicals have been well up to schedule and among the miscellaneous items formaldehyde, white powdered arsenic, hydrogen peroxide and borax are all moving well. There has been good support for the non-ferrous metal compounds while a fair volume of new inquiry has been in circulation for the solvents. Active conditions continue in the coal tar products market and pyridine and creosote oil are in strong request.

MANCHESTER. — Textile manufacturers generally, including the rayon and woollen sections, seem to be taking smaller quantities of chemicals than was the experience just before the turn of the year, but in most other directions a continued steady demand has been reported on the Manchester market during the past week. The volume of export business has also been maintained at around the recent level. In virtually all sections of the trade firm price conditions are ruling. Although there is a fair movement of supplies, business in fertiliser materials has not yet reached the normal volume for the time of the year. In the tar products section there is steady pressure for deliveries.

GLASGOW.—There has been very little change in the overall position in regard to general chemicals for home trade consumption. If anything, the demand has been slightly easier, probably due to the easing in prices of numerous products. In general, however, manufacturers and merchants alike appear to be well satisfied with the week's trading. With regard to export, demand during the past week has not been so intense but the position appears favourable.

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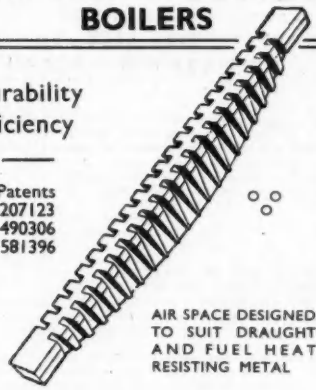

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CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive, or a woman aged* 18-59 *inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

APPLICATIONS are invited by the **MINISTRY OF SUPPLY** for the following posts at the **TROPICAL TESTING ESTABLISHMENT,** Port Harcourt, Nigeria.

SENIOR SCIENTIFIC OFFICER.—POST 1: Physicist or Electrical Engineer to lead a group of physicists and engineers studying the effects of tropical conditions on service materials and equipment. Candidates should have experience in one or more of the following fields: electrical or mechanical testing of materials, or electronics. Some knowledge of statistical analysis or meteorology would be an advantage. (Ref. A36/52/A.) POST 2: Chemist or Biologist to lead a group of chemists and biologists studying the effect of tropical conditions on service materials and equipment. Knowledge and/or experience of physical chemistry and mycology is desired. (Ref. F96/52/A.) Candidates for posts 1 and 2 must be over 26 years of age and should have a 1st or 2nd class Honours Degree in the appropriate subject or equivalent qualification with at least 3 years' post-graduate, research experience.

EXPERIMENTAL OFFICER OR ASSISTANT EXPERIMENTAL OFFICER (2).—Candidates should have at least Higher School Certificate or equivalent qualification in science, including Physics, with experience in Electrical or Mechanical Engineering. Higher qualifications may be an advantage. For one post a mechanical engineer with some knowledge of physics is desired. For the other, candidates should have a good knowledge of physics, preferably with some experience in one or more of the following fields: electrical or tensile testing of materials, including textiles and plastics, or meteorology. (Ref. A37/52/A.) The posts are unestablished and open to men only. Appointments are for an initial tour of 18 months, but further tours may be arranged by mutual agreement. Consideration will be given to further employment in U.K. at the end of service in W. Africa. Salaries will be assessed according to age, qualifications and experience within the following ranges: Senior Scientific Officer, £750 to £950 p.a. Experimental Officer (minimum age normally 26), £575 to £725 p.a. Assistant Experimental Officer, £250 (at age 18) to £535 p.a. The posts are unestablished, but the Senior Scientific Officer posts carry benefits under F.S.S.U. Foreign Service allowance ranging from £200 to £500 is also payable, according to marital status. Accommodation is provided free. Subject to certain conditions, passages by sea from the U.K. can be provided at public expense for families. A detailed explanation will be given to candidates selected for interview. Application forms obtainable from **MINISTRY OF LABOUR AND NATIONAL SERVICE, TECHNICAL AND SCIENTIFIC REGISTER (K), 26, KING STREET, LONDON, S.W.1,** quoting appropriate reference number.

CHEMICAL ENGINEER. THE MIDLAND TAR DISTILLERS, LTD., OLDBURY, NEAR BIRMINGHAM, require a fully qualified Chemical Engineer with several years' experience in industry. An ability to apply sound knowledge and experience in the design and development of new chemical projects is of the first importance. Age 27-35. Good salary offered according to age and experience, etc. Contributory pensions scheme in operation. Applications, with full particulars, to PERSONNEL MANAGER.

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APPLICATIONS are invited by the **MINISTRY OF SUPPLY** from **CHEMICAL ENGINEERS,** for appointments in the grade of **SENIOR SCIENTIFIC OFFICER,** at a Research and Development Establishment in S.W. England. Housing accommodation will be made available (if married). Selected candidates must be prepared to work elsewhere initially for a short time. Candidates should have a 1st or 2nd Class Honours Degree in Chemical Engineering or in Chemistry, with a post-graduate course in Chemical Engineering, or equivalent qualification. They must be at least 26 years of age and should have had at least three years' experience in the research and development of chemical processes, including the design and operation of semi-technical and pilot units. Ability to control and direct scientific industrial staff is essential. The posts are open to male candidates only. Salary will be assessed according to age, qualifications and experience within the range: £720 to £910. The posts are unestablished but carry F.S.S.U. benefits. Application forms obtainable from **MINISTRY OF LABOUR AND NATIONAL SERVICE, TECHNICAL AND SCIENTIFIC REGISTER K, ALMACK HOUSE, 26, KING STREET, LONDON, S.W.1,** quoting F.953/51/A. Closing date, March 22nd, 1952.

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SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES The Civil Service Commissioners invite applications for permanent appointments to be filled by competitive interview during 1952. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1952, may eventually be announced. Successful candidates may be appointed immediately. The scientific posts are in various Government Departments and cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. The patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a University Degree with first or second-class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification, or for scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must, in addition, have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and patent posts taking their Degrees in 1952 may be admitted to compete before the result of their Degree examination is known.

Age Limits: Senior Scientific Officers, at least 26 and under 31; for Scientific Officers and Patent Classes, at least 21 and under 28 during 1952 (or under 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London Salary Scales: Senior Scientific Officers (men), £812 10s.-£1,022 10s.; (women), £681 5s.-£917 10s.; Scientific Officers (men), £440-£707 10s.; (women), £440-£576 5s.; Patent Examiner and Patent Officer Classes (men), £440-£655. (Rates for women under review.) Somewhat lower rates in the provinces.

Further particulars from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting No. S. 53/52 for Senior Scientific Officers and S. 52/52, S. 128/52 for the other posts.
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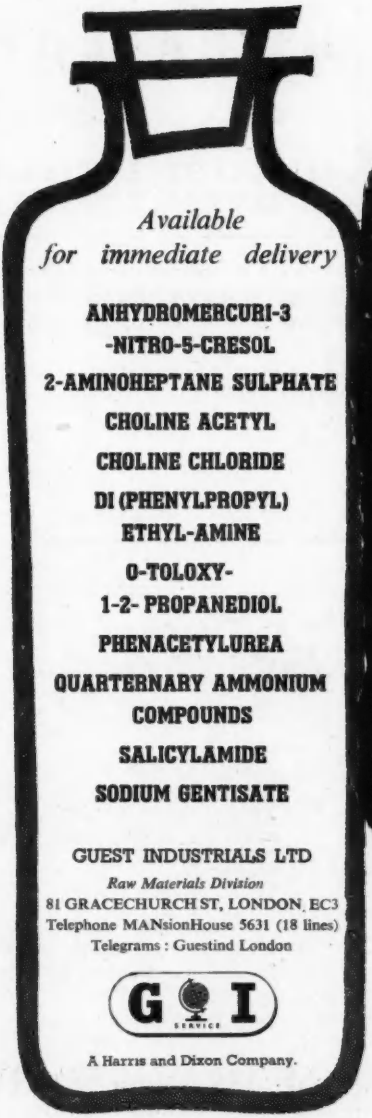

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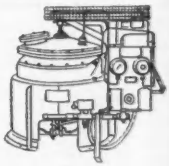

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